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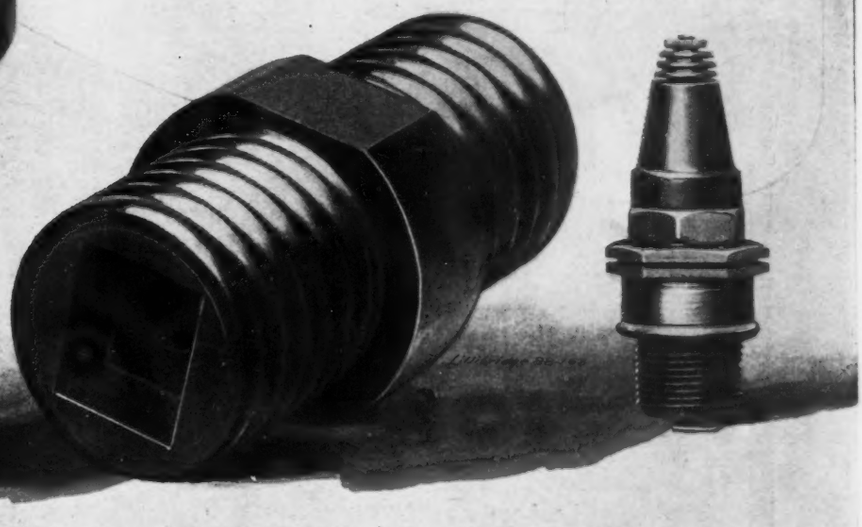

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Tax on Intelligence

THE publishers of the ELECTRICAL WORLD announce that on and after July 1 it will be necessary to add an extra dollar to the subscription price for all readers residing west of the Mississippi River. This will be done partially to cover the increase in postage that becomes effective on that date.

The zone law enacted by the last Congress and covering second-class postage divides the United States into eight zones, with a different rate of postage applying to each. Under the old law the postage on a copy of the ELECTRICAL WORLD to San Francisco or any other part of the United States was approximately 56 cents a year. On July 1 it becomes $2.49 a year for the eighth zone, which includes the Pacific Coast, and $2.28 and $1.87 in the seventh and sixth zones, in which the states west of the Mississippi lie. Under this zone postage system there will be another increase in 1921 making the postage on a copy of the ELECTRICAL WORLD $4.33, $3.92 and $3.10 respectively in the eighth, the seventh and the sixth zone.

When the first postage increase of the zone system became effective in July, 1918, its unfairness seemed so evident that the publishers decided to bear the burden, in the belief that the law would soon be repealed. One year has passed, however, with every prospect that an unfair and discriminatory piece of class legislation against educational periodicals will be perpetuated unless readers make it their business to demand the repeal of the present zone postal law.

The ELECTRICAL WORLD'S function is to express nationally the point of view of the industry. We have no desire to discriminate against readers west of the Mississippi River and are anxious to present the Pacific Coast point of view to the industry, thus making its ideas a part of national ideas and not merely local issues. It is most unfortunate that Congress should erect such a barrier at a time when unanimity in thought, action and deed is so essential. The reëstablishment of the zone system, which was declared obsolete and abolished in 1863, is certainly a step backward and should be quickly repealed.

The government under public ownership could probably raise new capital much more cheaply for a time than the majority of the utilities, but the savings obtained in that way would easily be obliterated by extravagance and lack of concentrated and continued responsibility under such a program. With public ownership and operation once instituted, its advocates would find no deficiencies; the latter would be hidden in the annual appropriation and tax bills, or else covered by continued rate increases.

External-Anode Vacuum Tubes

THE three-electrode vacuum tube is now a well-known device in electrical engineering and has recognized utility and a wide range of application. While it was originally developed as an amplifier for radio-signaling, it is also readily used as a detector. It has also been availed of as an oscillating-current generator, or as a transformer from direct to alternating currents, and has been used as an automatic regulator in various circuits.

In the typical three-electrode vacuum tube all three electrodes are supported inside the exhausted chamber. One is a filament, or electrically heated cathode wire. The second is a metallic grid, or control electrode, which serves to regulate the electron flow, or current, from the hot cathode. The third is the metallic plate, or anode, which is connected with an external direct-current source. This source supplies the electric energy released or utilized in the device.

An interesting and promising form of three-electrode tube, in which only two of the electrodes—namely, the cathode filament and the grid—are inside the exhausted chamber, is described in this issue by H. P. Donle. The third electrode—*i.e.*, the plate—is a silver coating on the outside glass wall of the chamber. In this device the electron flow reaches the anode by electrolysis through the heated glass wall.

Electric flow is supposed to occur in conductors by a transfer or handing on of electrons from one molecule of the conducting substance to the next in line. In non-conductors the flow occurs, as is believed, in a different way. In gaseous non-conductors free electrons are projected along the lines of electric force, and they tend to disrupt the molecules that lie in their paths. The electrons released from the débris of the injured molecules are free to join in the stream, and so a powerful current flow or discharge is precipitated as soon as the electric field reaches the blasting strength. In liquids the distances between molecules is not ordinarily sufficiently great to permit of electrons acquiring high trajectory velocities; so that the peaceable migration of free electrons is supposed to be involved, the movement being initiated by the impressed electric force acting through the volume of electrolyte. The electrons are so mobile within the electrolyte that a relatively small electric field intensity will set up a powerful procession or strong electric current.

In non-conducting solids the process of conduction is supposed to be of the same general nature as in non-conducting liquids; but, owing to the relative rigidity and immobility of the substance, a much more powerful electric field must be impressed on them in order to induce free electronic motion, and their velocity of transition through the solid substance is naturally much

less. The rate of electronic flow is, however, greatly assisted by heat, which, in giving vibratory agitation to the molecules, permits the electron more easily to shuffle through. The result is that the electrolytic current through solid non-conductors often increases very rapidly with rise of temperature.

In the new vacuum tube, with external plate coating, the glass wall becomes warmed by the heated filament up to the point at which it conducts electrolytically with sufficient ease to permit of carrying the relatively small current density supplied to the device. The temperature does not rise, however, to the point at which the glass walls soften or rapidly deteriorate.

The curves accompanying the article indicate a sharp and sudden bending of the anode current at a certain critical control potential applied to the grid. This abrupt change of the virtual conductance in the plate path is a valuable feature when the tube is applied as a detector. It means that the tube can virtually rectify an alternating potential difference between the filament and grid by giving rise to a pulsating unidirectional current in the plate circuit.

The simplicity, compactness and ruggedness of construction in these external-anode tubes commend them for many purposes, especially when portability is desired. It is to be hoped that, in actual service, the tubes will be found to come up to expectations.

Plant efficiency is seldom a simple function of station capacity. Small central stations often exhibit surprisingly good economy when run under favorable load factors. Skill in utilizing available resources counts heavily in the race for low production costs.

Engineering-Civic Associations

FROM Duluth, from Youngstown, from St. Louis, from Milwaukee and from other points news has come of a new and different sort of engineering-civic activity. Electrical engineers and electrical business men are combining with all other engineers—civil, mechanical, chemical, etc.—for a common end. They are forming centralized local associations or clubs which have an engineering background. These bodies are, from judgment based on their statements of aims and objects, the result of a desire for several things. They fill a need for a common meeting place for all engineers, a clearing house for general engineering discussion and a mobile organization through which the best engineering thought in the community can be effectively applied to the local civic and political problems.

To the individual engineer—and especially to the younger men—such an organization offers an opportunity for a broader viewpoint, a wider acquaintance and a sort of post-graduate education. To corporations based on engineering it can also be helpful in assisting the lay public to a better understanding of the technical problems with which the city is concerned. The public also gains by bringing straight-thinking engineering minds to bear on public works that are now too often handled entirely from a political standpoint. Locally, therefore, the clubs are a good thing and deserve to meet encouragement.

However, many of the local bodies are not entirely content with a limited sphere of action. They want a national affiliation. Some have even written into their constitutions clauses to the effect that the organization shall affiliate itself with a national body when one is formed which has aims and objects similar to their own. Just where this national body is to spring from no one appears as yet ready to say. That it can do excellent national work is fully admitted. As an instance of the kind of work it might take up, attention may be called to the necessity for some such organization to handle certain phases of promotional activity in the movement for a national department of public works headed by an engineer. At any rate, this general engineering-civic movement is well under way and is important enough to merit the attention of those who have genius for properly organizing an industry.

It is in the public interest that the capital required for the enlargement and betterment of utility service should be voluntarily furnished by private investors under the attraction of a satisfactory rate of return and degree of safety. Regulation must be both responsible and reasonable.

Some Details of Industrial Equipment

WE TAKE pleasure in adding to the article by E. E. George on "Industrial Maintenance and Rehabilitation Methods," printed last week, some interesting details of arrangements adopted in the plant with which he is connected to meet conditions that would in many cases be found difficult. One of the not unusual annoyances in industrial plants is the collection of current for the often numerous cranes in use. Perhaps the commonest arrangement is a shoe contact made with a supply wire rather flexibly supported on rollers. It works well under conditions of accurate alignment but wears out shoes rather rapidly and gives trouble if there is any end play of the crane on its rails. It is apt also to catch and pull the line down and wear the wires rather severely. Investigation in this case showed that the most satisfactory of all systems is that with double third-rails as applied to big shipyard work. This method is extremely efficient but rather expensive and difficult to apply to crane runways not originally built for it.

After a careful study of the situation the engineers designed a rather simple trolley system which has turned out extremely well. It consists of a standard street railway wheel and fork mounted on a short pole with a vertical motion imparted by a spiral spring pressing it against the trolley wire. This was a No. 0000 size, pulled very taut, the flexibility of the contact being given by the up-and-down motion of the pole, which slid in two well-fitted brass collars and was kept in electrical connection by flexible cable. The original equipment is still in use after twelve months, so that from the standpoint of durability as well as efficiency the contact leaves little that could be desired by any one in the circumstances under notice.

In wiring the buildings, including the office portions, exposed standard conduits were used, it being wisely decided that this conduit was quite as ornamental and less conspicuous than steam, gas and sprinkler pipes. The results have been entirely satisfactory. All portable and adjustable lamps in the offices were done away with and a first-class system of indirect lighting was installed. The service wiring was mainly along the roof trusses with high-grade rubber-covered wire run in rigid conduit for the service leads. For the various

motors manual starting boxes were discarded and automatic starters took their place. For reversible and variable-speed motors automatic starters with push-button control were freely used, and in general the knife switch with fuse, so common in motor installations, was once and for all put out of the way. Another very useful innovation had to do with the illumination of the plant. In working at night overhead and in crowded basements or other space a good deal of difficulty is found in getting sufficient illumination, the ordinary service lights being hardly sufficient for the unusual duty of lighting for special repairs in out-of-the-way places. To meet this necessity a portable floodlamp with a 1000-watt gas-filled lamp in a suitable reflector was fitted up. The reflector was given universal motion and the whole thing clamped on a small truck with rubber-tired wheels and provided with a 100-ft. (30-m.) cord attachment. This outfit could be trundled around wherever necessary and brought into action in dark corners where the regular lighting or portable lamps would not make any serious impression. The labor saving in maintenance operations secured in the way indicated proved to be very material.

Finally, the line shafts were supplied with ball bearings, which were estimated, and probably correctly, to save at least 20 per cent on the power consumption of the machine-shop motors, and which incidentally obviated the need of an extra generator, the load in this way being kept down to the readily available capacity. Even the loose pulleys were eventually supplied with ball bearings which relieved a very considerable part of the ordinary repair work.

All told, this is a record of very efficient equipment and management, and it teaches an extremely useful lesson as regards ultimate results in plants for industrial purposes.

Now and then a medium-sized installation gives a plant half a dozen times its size a close rub in economic performance per unit of output. The day of superplants is here, but they must justify their "place in the sun" by their works. Meanwhile the smaller stations should strive to attain the best that lies within them.

Installation and Testing of Primary Meters

WHEN a consumer's plant covers a relatively large area it becomes possible to supply energy to it at a number of points, each with its step-down transformer and watt-hour meter, or else to supply energy to it at a single point, through a single watt-hour meter, and distribute from this point over 2200-volt mains. In the latter case the metering is simplified, but the meter records energy delivered at a relatively high pressure. It then becomes desirable to standardize the meters for this higher-pressure service. There are three possible bases for standardization. One is to install 2200-volt meters in the circuits, both as regards voltage and current. A second is to use, say, a 220-volt meter, with both voltage and current transformers. A third is to use a 220-volt meter with voltage transformers but without current transformers, the meter windings being inserted in the main circuit.

The advantages of these various methods are discussed in an article this week by Halbert R. Thomas. A plea is made for consistent procedure, so that whatever plan is adopted in one installation should be followed, as far as possible, in all similar installations supplied by the same system.

The nub of proper supervision lies in seeing that hurtful discriminations in rates or service do not exist and that the price schedules yield an adequate but not an excessive return upon the investment. Supervisory interference with managerial functions without responsibility for results adulterates the regulative ideal and deprives the public of normal utility development based upon mutual interests and the most expert administration.

Cost Comparison of Transformer Types

IN THE early days of alternating-current transformers their designs fell into two distinct classes, namely, core-type and shell-type transformers. In the former the copper winding was distinctively on the outside of the steel core. In the latter the steel core was the salient external structure within which the copper winding was embedded. There was much difference of opinion concerning the relative merits of these two types, in relation to various features, such as convenience of manufacture, efficiency, heating and cost. Each type had its strong protagonists. As time went on, however, and transformer design became carefully studied, it was found that the differences between the behaviors of the two types diminished, and at the same time the structural differences between them diminished. The problem before the designer is to link an electric circuit system with a magnetic circuit system in such a manner that the electric current density in the former and the magnetic flux density in the latter attain suitable working values while preserving mechanical convenience and electrical insulation. The process of design then often leads to a structure which is hard to classify between the core and shell types.

Prof. B. C. Dennison gave last week an analysis of the most economical design conditions for five types of 75-kva. single-phase transformers using the same working current density and the same iron space factor throughout. The designs being conducted according to rule, the weights of iron all come out within 9 per cent above or below the mean of the five types, and the weights of copper within 7 per cent. The total costs come out with 5 per cent above or below the mean. The computed efficiencies are all within 0.08 per cent of the mean. It is evident that, although the differences in cost are not negligible, the differences taken as a whole are relatively small considering that five different types are compared.

There are, however, various details of structural convenience and incidental economy which affect the selection of type in a factory and which it is very difficult to reduce to quantitative form. These minor considerations often play a leading part in making a decision. Nevertheless, it is always well to have the matters of geometrical construction reduced to arithmetic so far as may be possible. Inquiries of the kind dealt with in the article will therefore always be worth while. In particular, it would be desirable to have them extended to polyphase transformers. In Europe the preference has always been given to polyphase transformers for polyphase systems, whereas in America single-phase transformers in groups are nearly always adopted.

External-Anode Vacuum Tube

Results of Investigations Carried On with a New Type of Three-Electrode Vacuum Tube in Which Electrolytic Conduction Through Glass Performs an Important Function

BY H. P. DONLE
Radio Engineer Connecticut Telephone & Electric Company, Inc.

COMMERCIAL types of electron-tube amplifiers, detectors and oscillators in their present forms, although remarkable for adaptability and efficiency, have been developed along more or less well-defined paths and have deviated very little in principle from the original forms. However, a vacuum tube has been developed by the writer which not only differs radically in construction from those available heretofore but depends for its operation on what is believed to be a new phenomenon, namely, electrolytic conduction in a hot dielectric.

Aside from the simplicity, compactness and ruggedness of the tubes, they are especially interesting because their characteristic curves contain a right-angle bend which makes the tubes unusually sensitive detectors. By proper proportioning of the tube components this bend can be made to occur at zero-control potential. Operation without a polarizing potential on the control is a considerable advantage, because, although it is a comparatively simple matter to polarize the control by shunting the series condenser with a resistance of several megohms, these resistances, as made at present of loose particles, introduce considerable noise into the receiving circuit owing to their variable resistance. One form of the tubes is made to operate at an anode potential of 4 volts, which should be attractive wherever it is desirable to minimize the battery expense, reduce the weight or secure compactness. The exceptional oscillating properties of the tubes make them particularly adapted to use as regenerative or oscillating detectors. The construction and assembly of the tubes is so simple that manufacture on a quantity basis is considerably more feasible than with many other types now available.

A filament, a control electrode and an anode are employed as in other three-electrode vacuum tubes, but these elements are disposed differently, as shown in Fig. 1. The filament is shaped like a hairpin, and surrounding it is the control electrode, which consists of a helical coil of drawn-tungsten wire. These two elements are the only ones inside the tube, the anode being a silver coating applied directly to the outside of the vacuum tube on that portion surrounding the filament and control electrode.

The vacuum tube proper is very small, being hardly more than $\frac{3}{8}$ in. (9.5 mm.) in diameter where the electronic action takes place and only $\frac{5}{8}$ in. (15.9 mm.) at the base, where more space is required for assembling and sealing the tube after it is evacuated. With the outer glass shell in place, which is provided for protection against drafts and mechanical injury, the tube measures only $\frac{7}{8}$ in. (22 mm.) by $3\frac{3}{8}$ in. (85.7 mm.), compared with $1\frac{3}{8}$ in. (34.9 mm.) by 4 in. (10 cm.) for one form of vacuum tube which was very popular in the Signal Corps during the war.

Although very light in construction, this new tube is entirely unaffected by vibrations and uninjured by jars so that it is unnecessary to mount it on cushions as is done with some kinds of tubes. The alignment of the filament and control with respect to each other and the anode is not at all critical; it is only necessary that the filament be placed as near the center of the control as possible, and that the filament be

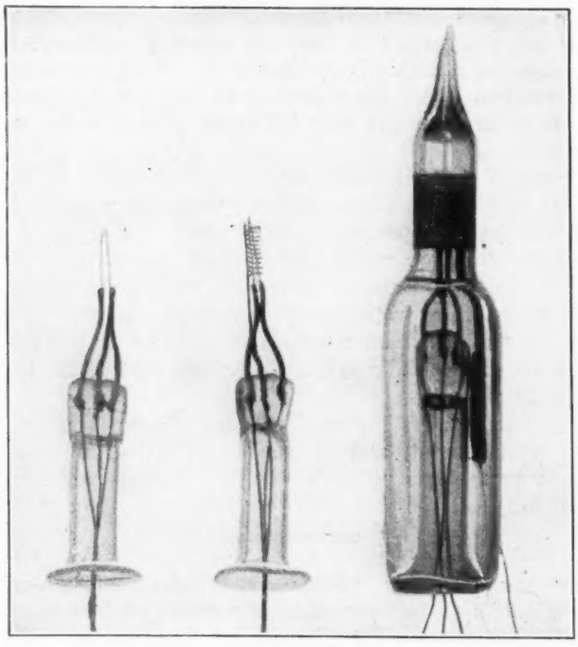


FIG. 1—FILAMENT OR CATHODE, CONTROL HELIX SURROUNDING FILAMENT, AND SILVER DEPOSIT ON OUTSIDE OF TUBE SERVING AS ANODE

somewhere near the center of the tube in order that the temperature of the glass shall be uniform.

At first it was expected that commercial variations in the glass thickness would materially affect operation, but such is not the case, for when made under ordinary conditions the tubes may be interchanged in any circuit without the necessity of readjustments.

In operation the tube is connected like any other three-electrode vacuum tube, except that the control electrode does not have to be polarized when the tube is acting as a detector. Since this tube is exhausted to the highest obtainable vacuum, the filament, when heated by its battery, is the source of a pure electronic emission which forms the connecting link for the battery between the filament and the anode electrode, the resistance of this connecting link varying with the potential of the control.

The point of immediate interest is the passage of current through the glass. Up to the present time glass has been looked upon as a fair insulator, at least, although it has been known that at or near the melting point it becomes a good conductor. This property of becoming strongly conductive when heated

to a semi-fluid state is probably shared by all other so-called dielectrics; but it is obvious that it would be absolutely impossible to operate a vacuum tube at such a temperature since glass begins to soften at approximately 425 deg. C. and does not attain red heat until heated to about 600 deg. C. However, when glass is in contact with certain elements, it becomes a good conductor at far lower temperatures than these. The conduction through it when in this condition is purely electrolytic, and all the phenomena accompanying conduction through a liquid electrolyte, such as decomposition, polarization, etc., are present in hot glass.

Before making these tubes conductivity tests of glass in contact with various elements were made by pre-

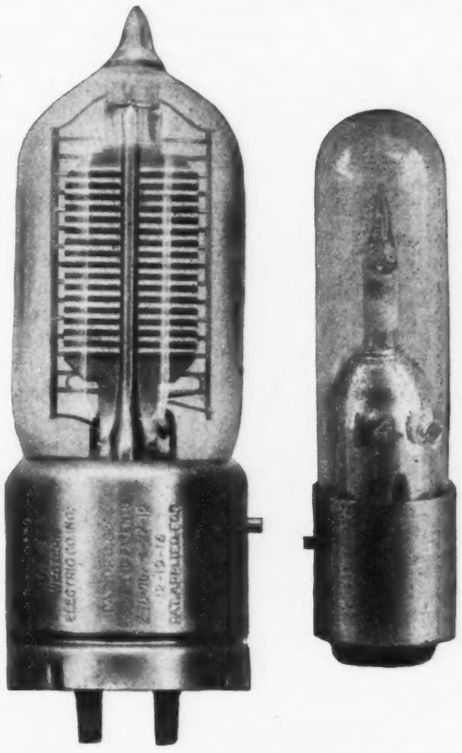


FIG. 2—RELATIVE SIZES OF ARMY VACUUM TUBE AND RECENT DEVELOPMENT

paring short lengths of glass tubing with a band of the metal surrounding the outer circumference near the middle of the tube and a second band of the same metal inside the tube immediately under the outer band, this tube being heated to the required temperature in an electric oven. It was found that when using electrodes of such elements as copper, tin, iron, nickel, platinum, etc., an apparent polarization took place which very greatly increased the resistance of the combination. This is without doubt due to an electrolytic action at the anode surface which renders it almost non-conductive. If the source of potential be short-circuited while the glass is in this condition, the energy held on the electrode surfaces will be returned through the circuit. All of these phenomena, although, of course, perfectly commonplace in a liquid conductor, have, it is believed, up to the present been unknown in a solid.

With silver electrodes polarization is almost entirely absent; so much so that glass with one electrode of silver and one of nickel will at the proper temperature become a fair conductor when the silver is the anode terminal of the applied emf., but will have a very high resistance with silver as the cathode. Current-temperature curves for two glass samples, one with both electrodes of silver and the other having two platinum electrodes, are shown in Fig. 6, the applied potential in each case being 20 volts.

It might be supposed that the electrolytic disassociation of the glass walls would make it impracticable to operate a tube in this manner. However, this was

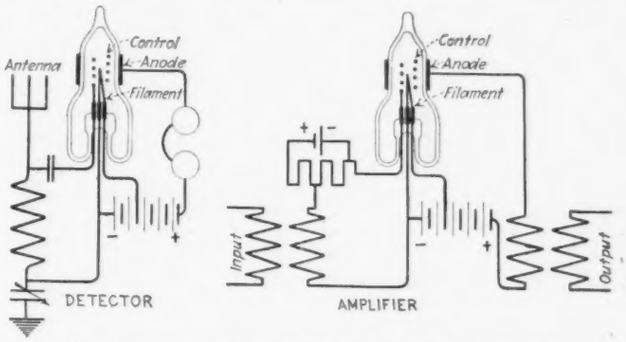
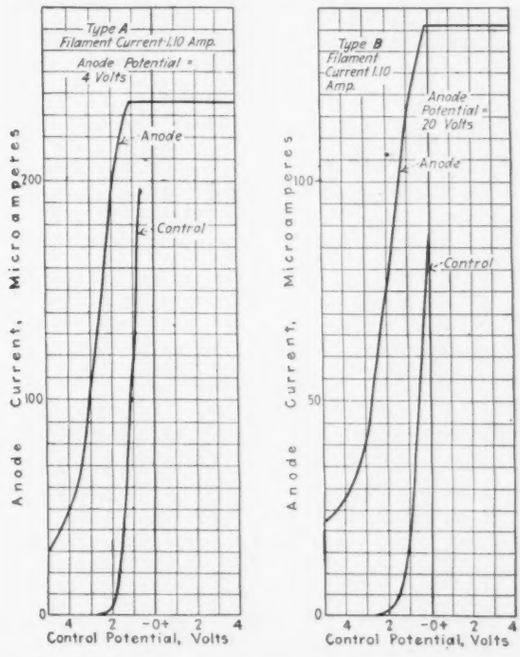


FIG. 3—METHOD OF CONNECTING THE NEW TUBES WHEN USED AS DETECTORS AND AMPLIFIERS

found not to be the case; for it is entirely feasible to so distribute the current density and magnitude that disassociation will take place at a very low rate and the glass life will be one of the smallest factors in the tube life.

Several types of tubes operating by the conductive properties of heated glass have been designed, the glass being heated to the required degree by the filament and maintained at its proper temperature by inclosing the tube within an outer shell of glass. This is



FIGS. 4 AND 5—CHARACTERISTICS OF TYPES A AND B TUBES

provided with vents at its lower end in order that the temperature shall not exceed the proper value.

The evacuation of a tube of this type is extremely simple, for, owing to the very small metallic areas exposed (only several square millimeters instead of as many square centimeters) and their close proximity, it is possible to scavenge the tube of gas by simply

lighting the filament and applying a low potential between one leg of the filament and the external anode. The aging potential applied is usually twice the normal operating value. With the first application of this potential there is an emission of gas from the glass tube which is drawn off by the pump, but after a few minutes this ceases and there is apparently no further emission from this source during the life of the tube. During the process of glass disassociation there is a continuous liberation of metallic sodium from the heated portions of the tube, which deposits in the form of a bright silvery coating in the cooler portions of the glass. The presence of this active element within the tube partly accounts for the cleaning up of any occluded gases which may be caused by melting of the constricted portion that connects the tube with the pump when the tube is sealed. With these tubes the presence of gas is very noticeable after sealing, but after a few minutes of normal operation it is to all indications no longer present.

The characteristics of these tubes show one peculiar feature, namely, the flattening of the anode current-control potential curve at or near zero-control potential. The cause of this is readily explained as follows: In this tube there are in effect two resistances—that from filament to inner wall of the tube R_s and that of the glass walls R_g. The latter is nearly a fixed value, determined largely by glass temperature and somewhat by current passing through it, but R_s depends entirely upon the charge residing on the control. It is obvious therefore that as the control is made more positive this resistance is decreased until a point is reached where it is inappreciable compared to R_g. In this condition R_s is the controlling factor in current flow between filament and anode.

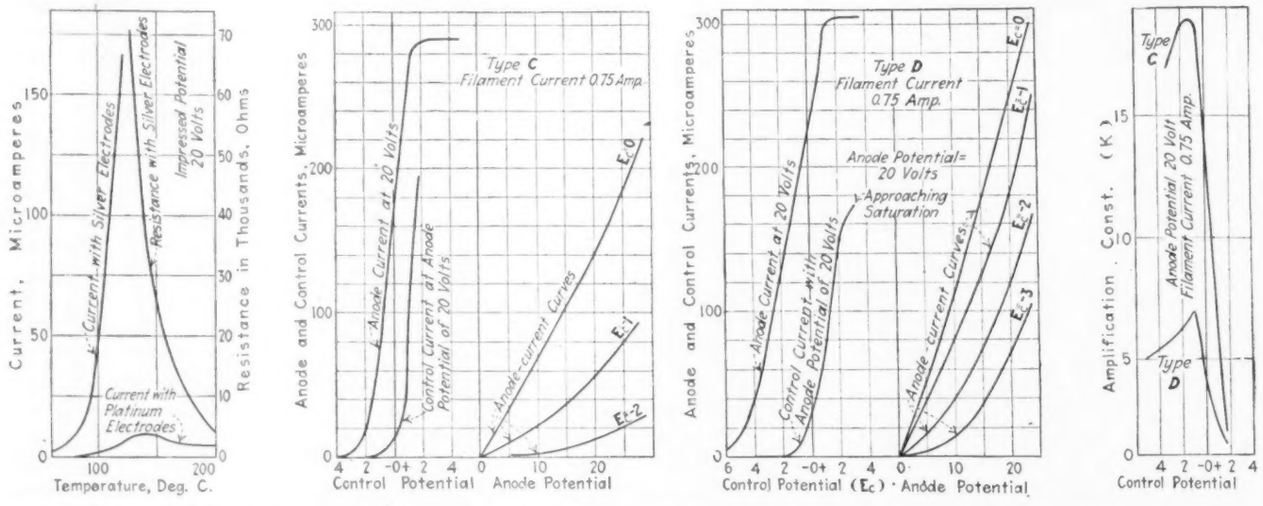
The characteristics of the four types of tubes now being made are shown by the accompanying curves. Under normal conditions of filament current and anode potential, for example, the right-angle bend in the anode-current curve of a type A tube occurs at —1 control volts and with 236 microamperes flowing in the anode circuit. With a type B tube the right-angle bend occurs at zero control volts and 172 microamperes. Types C and D, on the other hand, have the bend occur at positive control potentials (1 volt to 2 volts) and with 290 and 304 microamperes flowing respectively.

Used as detectors or oscillators, these tubes operate best when a condenser is in series with the control element, although they will operate on the lower portion of their characteristic curves with the control charged negatively. However, the latter method of operation is not so satisfactory as the first.

Decreasing the anode potential causes the bends to occur as usual at more positive control potentials and with less anode current. Because of these right-angle bends it is preferable to operate the tubes at the control potential where they occur if the best detecting characteristics are desired. When used as amplifiers, the control potential is maintained at that value giving the greatest increases or decreases of anode current with variations of the control potential. In this connection it may be noted that the type C tube is particularly adapted to amplification because of the steep current curve, which is still further improved by lowering the anode voltage. The characteristics of the type D tube are particularly interesting because they show the enormous effect produced by the control element, which has only 70 per cent of the turns in type C. The amplification constants of these two tubes at varying control potentials are shown in Fig. 9, type C amplifying more than nineteen times under best conditions. These constants were calculated by the method described by Leslie Miller in the *Proceedings* of the Radio Institute.

NORMAL OPERATING CONDITIONS OF THE VARIOUS TUBES

Type of Tube	Filament Current (Amp.)	Anode Potential (Volts)	Acting as Detector	Acting as Amplifier
A	1.1	4	Condenser in series with control	.....
B	1.1	20	Condenser in series with control....	.....
C	0.75	20	Condenser in series with control....	Control polarized—1 volt
D	0.75	20	Condenser in series with control....	Control polarized—1 volt



FIGS. 6, 7, 8 AND 9—CHARACTERISTICS OF GLASS AS A CONDUCTOR, AND PERFORMANCE OF TYPES C AND D VACUUM TUBES AS DETECTORS AND AMPLIFIERS

The characteristics of these tubes have been checked by Dr. Chaffee of the Cruft Laboratory, Harvard University, and the author wishes to express his appreciation of his most valuable coöperation.

Improvements in Industrial Plant Operation

Simplicity in Electrical Construction Methods Makes Interruptions Less Frequent, and These Are Readily Remedied—A Substantial Crane Collecting Device—Records Enable Engineers to Select Best Apparatus

BY E. E. GEORGE
Electrical Engineer, Chicago, Ill.

DEFINITE information regarding improved methods of electrical construction and operation in the plant of the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, was set forth in an article contributed by the author of this paper, under the title "Industrial Maintenance and Rehabilitation Methods," published in the last issue of the ELECTRICAL WORLD. Equally important developments at this plant are reported in the present article. In particular a crane collecting device is described in detail which the author considers much better than any such device heretofore available. Features of interior wiring methods are given which make for simplicity and ready repair. Portable floodlight units are shown to be useful in maintenance work. And, finally, it is pointed out that records should be kept which enable the engineer to select apparatus and supplies on the basis of the experience which the company has actually had with such material.

FIG. 1 — FEATURES OF IMPROVED METHODS IN INDUSTRIAL PLANTS

A—New design of crane collector. B—Office ceiling showing exposed conduit work. C—Portable floodlight for maintenance work; rubber tires prevent breakage of 1000-watt lamp.

Circuit breakers were installed to replace fuses on all crane circuits. Fuses would not blow quickly enough to prevent burning the wires in two if they got shorted by any means. Later the entire crane system was redesigned so that the wires could not get together. The ordinary arrangement of crane wires vertically over each other, fastened rigidly only at each end, with intermediate roller supports to reduce the sag, has been a source of trouble in nearly every industrial plant, but it is the usual arrangement, particularly on outside cranes. When this system was in use the costly bronze sliding shoes required renewal about every two weeks. They jumped the wires if there was the least lateral misalignment or any end play of the crane on the runway. After being slightly worn they caught on every splice and often pulled the line down, which, being in one long span, was difficult to pull up and replace on the supports. They wore out the wires very rapidly. They could only be used on vertically arranged floating trolley wires, which were unsatisfactory in a long building.

An investigation of industrial crane systems led the writer to the following conclusions:

(1) The double third-rail system, recently developed for heavy shipyard cranes, is the only really satisfactory crane collector device on the market. This system is expensive to install, but it is very desirable for extra-heavy cranes. It is usually difficult to apply to runways not specially designed for third-rail supports.

(2) The sliding-shoe system for floating vertically arranged trolley wires has not been a success.

(3) The rigidly mounted roller system for floating vertically arranged trolley wires cannot collect heavy currents and is subject to the usual troubles inherent in a system of long, floating trolley wires.

(4) The short trolley poles commonly used on rigidly supported trolley wires will not operate backward any more successfully than the ordinary street-car trolley poles, except on tight wires at low speeds.

(5) The pantograph collector would be extremely serviceable, but it is expensive to construct and requires much more head room than is usually available.

A device described in the following paragraphs was designed by W. O. Sims, the company's tool engineer, and by the writer and was built in the company shops. After twelve months' trial it has given perfect satisfaction, and it has lately been standardized for all future installations. A standard street-railway trolley wheel and harp (or fork) was chosen, as it was easily available and its design had not the test of heavy service. To avoid the necessity for manual reversal, the pole was mounted vertically, with a helical spring pressing it up against the trolley wire. There being little friction of the wheel on its pin, the only horizontal thrust on the trolley pole would be due to the sagging downward or curving upward of the trolley wire, so that the force passing through the center of the wheel and perpendicular to the wire would not be exactly vertical. This effect was reduced to a minimum by using No. 0000 wire, supported with "Sure Grip" clamps on 18-ft (5.5-m.) centers, and pulled very tight before and after partly tightening the clamps. In fact, the trolley wire was almost level with 30-lb. (14-kg.) pressure on the wheel at the center of the span. The trolley harp was insulated from the pole by a G. E. insulating hanger, threaded on both ends. The pole was a piece of cold-rolled steel rod, ¾ in. (1.9 cm.) in diameter and about 2 ft. (0.61 m.) long. The bearings for the pole consist of two brass collars, one 10 in. (25 cm.) above the other, ⅜ in. (9.5 mm.) thick, 2 in. (5 cm.) in diameter outside, and reamed to a sliding fit on the ¾-in. (1.9-cm.) poles. A single heavy iron casting bolted to the end sill of the crane carried the brass bearings

for the two poles, 8 in. (20 cm.) apart horizontally. A Dossert lug was bolted to each harp above the insulating hanger, and a piece of automobile battery-starting cable (extra flexible) was connected from the "Dossert" to the leads to the cab panel. The springs were designed just the right length to fit between the top brass bearings and the bottom of the insulating hangers. The wheels, poles and brass bearings can be renewed very cheaply, but after twelve months' service the original ones are still on the job. The standard malleable harps were widened about ¼ in. (6.3 mm.) and longer pins were put in, so that the wheels could have ⅛-in. (3.2-mm.) side play each way. The poles are not prevented from turning except by the grooves of the wheels following the wires.

INTERIOR WIRING METHODS

A radical change was made in the interior wiring of the offices. Previously all wiring had been concealed in wooden or metal molding or carried behind partitions or under floors. It was decided that electrical conduit was as ornamental as steam, gas and sprinkler pipes, so all conduit for fan, light, telephone and annunciator wiring was installed exposed and painted the color of its background. The results from the use of exposed standard conduit wiring for high-class office work were particularly satisfactory, even on white enameled ceilings. Portable and adjustable lamps were done away with. Indirect lighting was used in the offices, and Benjamin reflectors of the No. X5437 or of the No. 6127 type were used in the shops, hung at a uniform height above the floor. Conduit was provided for all telephone wires, from the instruments to the PBX switchboard. Intercommunicating telephones were discarded and replaced with Bell telephones having outside connections.

The ordinary support for wires and cables running along or over roofs is a wooden trestle of some kind, which is unsightly, makes objectionable holes in the roof covering, cannot be increased in insulator capacity easily, and deteriorates rapidly because of weather conditions. To meet these objections a unit-type steel pole or pin support was designed by C. E. Sinnige and put in service on all outside lines not carried on standard wooden poles. This "pin tower" consisted of a cast-steel pedestal, 18 in. (46 cm.) high, flanged at the base to about 6-in. (15-cm.) diameter, and tapering to a 1¼-in. (3.2-cm.) round boss at the top, which carried a No. 80 Pierce steel pin the long shank of which was bolted to the boss. The flanged base was drilled for four ½-in. (1.3-cm.) lag screws or through bolts, so that the "tower" would stand dead-end and corner strains without guying. The wires were thus supported about 24 in. (7.3 m.) above the surface on which the "towers" were mounted, which was sufficient for 36-ft. (11-m.) spans of "million cable" with large sags.

On lifting magnets Crouse-Hinds No. BPEA plugs and No. BRHD receptacles were used, one set on the magnet and one on the trolley carriage or in the cab. This permitted the magnet to be easily detached from the crane hook and prevented the leads being pulled out of the magnet. For all electric drills, office devices, portable lamps, electric grinders, etc., C-H No. RQ 302 plugs and No. RQK 302 receptacles were used. Several hundred receptacles were mounted in the shops, so that the 50-ft. (15-m.) cords on all portable devices would permit them to be used at any location. For outdoor work extension cords were made up with plugs on one end and receptacles on the other.

SIMPLICITY IN SERVICE WIRING

Most of the feeders were run along the roof trusses. Owing to the inaccessibility of cut-outs in the branch or service wires where they left the feeders and the consequent tendency to overfuse or to "copper" them, the Underwriters gave special permission to omit all ceiling branch cut-outs dependent on high-class construction and protection in the branch or service leads. Accordingly the service leads were double-braid, rubber-covered Okonite wire, run in rigid conduit to Detroit inclosed knife switches with non-renewable fuses or to Cutter circuit breakers, double-pole, with low-voltage releases, set to trip much more quickly than the low-voltage releases on starting boxes.

It was found that the depreciation was very high on all knife switches and starting boxes handled by the ordinary machine operator. In the matter of knife switches this was remedied to some extent by using the highest grade of switches available, such as the Glover type A, Crouse-Hinds type B, Walker type C, etc. All manual starting boxes were replaced by the Cutler-Hammer multiple-arm starters. For all reversing and variable-speed service current-limit automatic starters controlled by push-buttons or drum master switches were selected. On the new installations circuit breakers were used instead of fused knife switches. When placed near the operators ordinary circuit breakers are subject to the same objections as open knife switches. It is regrettable that no manufacturer has yet brought out (to the knowledge of the writer) a standard circuit breaker inclosed in a steel box or otherwise protected from chips, shavings, oil and from accidental contact with the operator or moving objects. Such a breaker is urgently needed in many industrial plants where the machine operators must have the control equipment quickly accessible. High-class breakers are not easily built for front connection, and it is difficult to erect and connect a back-connected breaker in a standard steel panel box. The nearest approach to an inclosed breaker is the General Electric "government type" circuit breaker. Strange to say, it seems that the government arsenals are ahead of private concerns in realizing the need of high-class equipment of this type. This G. E. breaker is really a magnet switch, as it is held closed by an inductive shunt coil, and as such it cannot perform all the functions of a circuit breaker, but it is a step in the right direction. Perhaps the fact that circuit breakers were originally designed for switchboard use exclusively has much to do with their present appearance. The Crane company of Chicago centralizes all of its service breakers in one room, thus realizing switchboard conditions and insuring attention by electricians; but this commendable practice is not possible except in certain new plants. All power receptacles were protected by service cut-outs of the Crouse-Hinds No. YKK 302 type, mounted in YKC 33302 boxes, and were installed as carefully as motor circuits.

In spite of carefully planned illumination for all productive work, the electricians, millwrights, belt men, pipefitters, riggers and the rest of the maintenance gang usually have to contend with semi or total darkness on all work overhead, in basements, behind boilers, in attics, etc., especially at night. To meet this difficulty,

a portable floodlight was rigged up. It consisted of a 1000-watt nitrogen lamp in a Benjamin deep-bowl reflector, mounted on a U-shaped pipe support, which was clamped to a small truck with rubber-tired wheels. By loosening the clamps the lamp could be rotated in a vertical plane, while the truck could be moved to rotate the lamp horizontally. A 100-ft. (30-m.) cord and RQ 302 plug were attached to the reflector socket. This light was particularly valuable for work behind switchboards, over counter-shafting and belting, in closed attics and in other places where the ordinary portable lamp hardly made any impression on the dark surfaces and large spaces involved. It was often borrowed by the painters, photographers, carpenters, etc., saving at least 20 per cent on all labor of the maintenance department at night.

All line-shaft bearings were changed to the S. K. F. ball-bearing type. This saved at least 20 per cent on

FIG. 2—HEAVY CABLES MOUNTED ON 18-IN. "PIN TOWERS"

power consumption of the machine-shop motors and obviated the necessity of purchasing an additional generator. Casting rattlers, fans, grinders, etc., were equipped with ball bearings. Later a ball-bearing loose pulley was designed and applied to countershafts and machines in place of friction clutches or plain-bearing loose pulleys. This ball-bearing pulley eliminated half of the millwright repair work, which consisted largely of rebushing worn-out loose pulleys. From the industrial electrical engineer's standpoint the use of ball bearings is an effective means of relief from overloaded generating equipment.

MAINTENANCE RECORDS

All dimension prints, surveys, foundation plans, wiring diagrams, etc., were copied by the photostat machine on 8½-in. by 11-in. (22-cm. by 28-cm.) prints and filed in folders. The originals were destroyed, unless valuable. Before photostating, a 3-in. by 5-in. (7.6-cm. by 12.7-cm.) card, on which was typewritten an index number and an appropriate title, was laid on one corner of the original so that it appeared on the print. A card index was kept of these letter-size prints. Layouts of the water piping, sprinkler piping, telephone circuits, fire alarm, gas mains, heating lines, electrical lines, etc., were kept up to date. The large-size tracings of these as well as the 8½-in by 11-in. (22-cm. by 28-cm.) prints were kept accessible.

As a perpetual inventory was kept of all equipment, a rather unusual classification of electrical purchases was made, dividing all materials into "expense" or "equipment" so that they could be charged to the proper account when bought, rather than when taken from the electrical storeroom to be used on a job. As the equipment accounts were subdivided by materials instead of by buildings or locations, it was not necessary for the maintenance or cost departments to keep any records of where and when materials were used. Strict rules were

SAMPLE PAGE FROM STANDARDS BOOK

Article	Solder	Salesman	
Preference	First	Address	
Manufacturer		Trade Name	
Address		Price	
Agency			
Address			

Our standard grades are:

Data N. L. No.	Per Cent Tin	Per Cent Lead	Melt. Deg. Fahr.	Strength	Use
...	66	34	356	Extra high	Brazing copper, etc.
111	50	50	401	High	Standard electrical
333	45	55	424	Medium	Sheet metal
777	40	60	446	Low	High melting electrical
...	33	67	488	Very low	Plumbing

All grades come in 1½-lb. (approximately) bars, in No. 10. B. & S. gage wire, and in No. 8 B. & S. gage wire. The wire is put up in 25-lb. coils and on 65-lb. spools.

enforced regarding the "scrapping" of equipment, and the cost department's representative always got a record of such items.

Every material that proved superior to its competitors or gave continuously good service in the absence of competition was standardized, and a record was kept of the maker, jobber, type, catalog number, technical data, etc., in a set of loose-leaf binders, called the "Standards Books" and highly valued by the works engineer and by the maintenance and purchasing departments. All requisitions were written by the works engineer, using these standard sheets for his information, or adding new sheets if the article was ordered for the first time.

The policy of standardization followed for the last three years was made possible largely by the vigorous support of the works manager, F. G. Kent. During the first two years, the writer was works engineer, while during the last year Stanley Nicholson has been in charge of the electrical work.

THE export of raw or semi-finished articles unquestionably adds to national wealth, but gives little aid to industry. We must export cotton in fabrics and not in the bale, iron and steel in machinery and implements, leather in shoes and other finished articles, use our coal under our own factory boilers and in every way multiply the overseas movement of products of hand and brain which our recognized manufacturing and inventive skill, unequaled by any other country of the world, so eminently fits us to produce. There always will be opportunities for distinctive American specialties, unique in character, the product of American originality, but to secure export trade in volume we must be prepared to supply what the foreign buyer regularly uses and always calls for.—*Edward Prizer, President Vacuum Oil Company.*

National Planning for Electric Power

Efficiency Must Lower Cost and Power and Human Resources Must Be Conserved—Secretary Lane's Proposed Survey Is Economic and Will Measure Present and Future Power Requirements

BY DR. GEORGE OTIS SMITH
Director United States Geological Survey

In his address before the National Electric Light Association at Atlantic City Dr. Smith presented the plans of Secretary of the Interior Lane for a survey of power resources.

THERE has been, fortunately, some progress in our ideas of what is the true relation between government and business. Governmental coöperation with business is the next step. In manufacturing, as in public service, the trend must be, not toward price lowering through competitive marketing, but toward cost lowering through competitive effort for efficiency. The idea that competition is productive of low prices has been over-emphasized in our laws, because public opinion has believed in that way of keeping big business under constraint and under control; but average prices cannot for any very long period be lower than average costs. Of course there is an exception to this—government operation can be camouflaged so that the taxpayer and not the consumer pays the cost. The government bureau, board or commission that seeks to protect the consumer will do well to help in the organization of industry on lines that will work out lower costs. The time is therefore opportune for broad planning, and there is no more urgent need than that of a power program.

To tell the National Electric Light Association at its forty-second annual convention that electric energy is man's best servant may be too much like "carrying coals to Newcastle." As I see it power is the great industrial need of the day—without it the speeding up of our nation in its recent great effort to help save the world would have been impossible The transportation of raw materials and manufactured products even in peace times calls for herculean energy—a power demand measured by more than 5,000,000 continuous hp.

In terms of cost, the best figures available indicate that motive power accounts for fully 30 per cent of the expense of operating steam railroads and for about 10 per cent of the well-managed electric railways. Aside from this difference in power cost, electric energy must be credited with the greater efficiency it makes possible.

The power element is smaller in manufacturing than in transportation, but not less important. In the making of cotton cloth about 2 per cent of the value of the product can be charged to power, while in the production of electrolytic zinc the power cost is around 12 per cent. In general, 2 per cent may be taken as a conservative figure for the power item in total manufacturing cost, and this may seem almost negligible; but the wider use of power in mills and shops has a larger effect than is measured by its own cost—the kilowatt-hour may double the product of the man-hour, and men cost more than kilowatts.

Electric power, as furnished from the large central stations, is favored by that happy economic law whereby the load factor works both ways. Lowering the cost of electric energy invites greater use, and greater and more diversified use permits lowered cost. That is no vicious circle; it is the virtuous upward curve of progress.

The future of power use is so encouraging that I dislike to pause and speak of the less attractive present. The story of wastes in our national career is not a pleasant one. American pride prefers to dwell upon those things that America does well. We have much to be proud of in our record of invention and construction and operation—indeed, the term "electrical" seems to describe something of purely American origin that has to be translated into the life of other peoples. Yet here in its birthplace and home the electrical industry is not so efficient as it should be. Your best engineers see the trouble—the growth has been so rapid that we have given too little thought to systematic development. Wonderfully well-thought-out units are scattered here and there, but these are widely separated islands in a sea of poorly planned or obsolescent plants.

INEXCUSABLE WASTE PERMITTED

The net result of this lack of system is that we permit wastes which are large items on the wrong side of our national ledger. You gentlemen know far better than I the wide span between your best records in large up-to-date central stations and the results obtained in smaller and too often obsolescent private plants. Measured by coal burned to the kilowatt-hour the ratio is one to two or three, or even more. Where else do we find such opportunities to cut down the coal bill? We can see even greater savings when we consider the advantages of hitching up American rivers and American coal—they work best in double harness. I believe that we are far from making full use of the water powers that lie undeveloped within easy transmission distances of our largest power markets. It is, moreover, time to count the rising costs of labor in the steam plant, where the coal miner as well as the fireman is an employee in fact, whether you see the miner's name on your payroll or not. The figures presented by the Alabama Power Company in its comparison of steam plant with hydro plant show the ratio of men employed as eighty-four to one. To the 1000 kw. of capacity twelve and one-half men in the steam plant and coal mine adjacent compare with one-sixth of a man in a hydroelectric plant. Conservation of human energy calls for the immediate and full development of every water power that is feasible.

The Secretary of the Interior offers a power program, and his program is inspired by a vision of future needs. He regards the almost insatiable demand for power created by war industries as foreshadowing future danger of power famine in the industrial districts of the Northeast. The signing of the armistice happily averted the power crisis that otherwise we should now be facing. Now, however, a policy of preparedness for peace expansion should be adopted.

We lack many of the basic engineering facts upon

which intelligent planning may rest. To fill this need the Geological Survey has undertaken a power survey of the United States. This survey is economic in its aim; it seeks simply to learn the facts relative to the sources from which power may be obtained and to compile all the facts relative to the existing plants, the quantity of power produced and the growth of power requirements.

As the first field of work, Secretary Lane has selected that area of maximum power density which he has chosen to call the North Atlantic industrial district. In this area, extending from the vicinity of Boston to that of Washington or Richmond and covering 50,000 square miles, is concentrated one-fourth of the power-generating capacity of the whole country.

The need of knowing the facts is realized when we try to measure even present power requirements, not to mention future demands. The Boston-Washington region uses 600,000,000 kw.-hr. a month, most of it derived from coal. The central stations alone consume fully 10,000,000 tons of coal a year. Add to this say 25,000,000 tons for the railroads in this area, and we begin to appreciate in a general way the part coal plays as a source of motive energy.

In conducting these inquiries the Geological Survey must of course rely upon the coöperation of the electrical industry, and, as was expected, this coöperation has been almost universally given, the Survey's analysis of February operations representing over 92 per cent of the output of the country. You will realize that a monthly report of the country's power output makes the most sensitive of business barometers, for unlike coal and steel records it is unaffected either by any carried-over surplus or by orders for future delivery.

I trust, too, that this coöperation is not one-sided, for the government bureau is in a position to assist your industry in many ways. I may mention one way: The manufacturer seeking a location for a new plant comes to the Geological Survey with his statement of requirements in raw materials, transportation, power and labor. From the knowledge obtained from you gentlemen this government bureau is able to suggest localities where he will be likely to get power at reasonable rates and to refer him to several power companies that can meet his requirements.

My own picture of the super-power system that would effect the economies demanded by the rapid growth in this industrial region includes a multiple transmission line of high voltage with its thousands of steel towers extending from Boston through our Eastern States, crossing the Connecticut near Springfield, the Hudson at Poughkeepsie, the Delaware near Easton, and the Susquehanna below York, and so on to Washington and Richmond. Into this unified system large-unit steam-electric stations at tidewater and near the mine mouths and hydroelectric stations—twenty or more—at old and new sites would deliver energy as required, and from this great power main would flow the energy to serve a score of railroads, hundreds of public service companies, thousands of manufacturing plants and millions of homes.

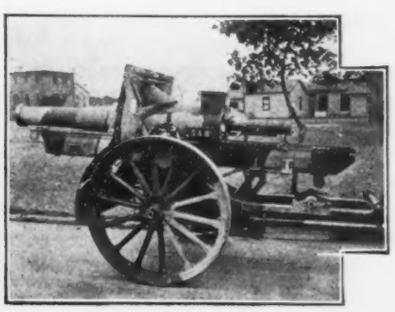
As one of my engineer friends remarks, this project would appear a "large order," and at first it staggers the imagination; but such a super-power line extending from Boston to Washington cannot be termed only a dream. If you take your map of the United States and make the West move East—which I admit is contrary to human experience—you can take one end of an existing trunk power line, which is at Tonopah, Nev., and lay that on Boston, and then the other end of the line, which is actually at Yuma, Ariz., can be placed at Norfolk, Va. What we dream for the East exists in the West, where the extreme tentacles of one system of interconnected power plants now have a reach of nearly 500 miles (800 km.).

The public interest in such an interconnected power supply is preëminent, but whoever suggests that the project is one for the government even to investigate independently neither appreciates the magnitude of the scheme nor realizes the limitations which hedge about a government bureau. If Congress authorizes this engineering study, your coöperation will be sought because needed.

As a nation bounded by the two oceans we own 55 per cent of the world's supply of coal, yet the tonnage of steam coal remaining in the great producing fields of the East is so limited as to make coal saving a topic deserving the best thought of those concerned in power generation. And coal from the more distant fields will be more expensive coal.

But Secretary Lane's program means more than saving in coal; it means saving in man power. One outstanding lesson of the war was the value of the workman behind the lines, and labor shortage became one of the limiting factors in the industrial support which we were able to give to our soldiers in France. Skilled labor is a resource in which no nation is richer than America, but this human resource also deserves to be conserved. The modern machine multiplies man power, and the increase in our use of mechanical energy is a true index of the ever larger value we are giving to the workman behind the machine.

Our interest as citizens in these plans for cheaper energy is far more than a commercial interest. Public service is a term that has come to attach itself to your industry, and not without reason. To improve living conditions for all our citizens must be the aim of those to whom is given the privilege of leadership in industry. To make this America of ours a better place to live in is the program for the electrical industry; that is your part in public service.



Installation and Testing of Primary Meters

This Matter Demands More Attention at the Present Time than Formerly Because Tendency Is to Supply Large Consumers with Electrical Energy at 2200 Volts, Metering on the Primary Side

BY HALBERT R. THOMAS
Southern California Edison Company

THE supply of electrical energy to private consumers at potentials of 2200 volts and more marks one of the increasing tendencies of modern distribution practice. Comparatively few years ago an industrial consumer whose plant covered a considerable area was usually supplied at a number of points, a bank of transformers and a meter being installed at each. To-day such a consumer is more likely to be served over his own 2200-volt lines from a centrally located substation, energy being brought to it at a suitable high voltage and stepped down by a single bank of transformers. The total is then metered at 2200 volts at the distribution bus. Besides simplifying the reading and billing, this arrangement is often of material benefit to the consumer in enabling him to take advantage of rates based on load factor. Furthermore, with the overcoming of insulation difficulties both large and comparatively small motors can now be wound for a sufficiently high voltage to make it unnecessary to use transformers between them and 2200-volt primary lines.

Standardization of Meter Equipment and Installation

Such conditions are demanding more and more standardization in primary meter equipment and installation. When high-potential metering was seldom found outside of stations the installation was part of the station lay-out and was strictly in accordance with the plans of the designer. Meters would be ordered on specifications stating capacity and would be furnished as a unit with their transformers. For consumers' installations, on the contrary, the equipment is usually ordered on a standard specification and kept in stock to be utilized as needed.

The practice, often followed, of rating meter and instrument transformers as a unit, using a register constant of 1, 10, 100, etc., has both advantages and drawbacks. The simplification of the constant and consequent ease of calculating consumption makes it more convenient for permanent installations, and it is highly desirable for stations where a large number of meters are employed. On the other hand, flexibility of equipment becomes of increasing importance in considering the average consumer's installation. Frequent changes of capacity are demanded by varying industrial conditions, while the location of the installation some distance from direct supervision increases the possibility of transformer and meter burn-outs.

When changes are made of either meters or transformers which are installed under the unit system the greatest care is necessary in order to keep the meter records correct. Both register and disk constants are necessarily altered with a change of transformer ratio, and a new register of different gear ratio must be installed to keep the register constant a power of 10. Several changes of this kind cause complications which may easily result in serious errors in constants.

In the alternative system the meter used is standardized, being always rated at 5 amp. and 110 volts with a register constant of 1. When installed with transformers the constant is invariably equal to the transformer ratio, and this ratio is all that it is necessary to refer to in checking up the constants. The meters are interchangeable and when not in use may be stored and handled independently of transformers.

The resulting constants, when transformers of standard ratio are used, will usually be convenient multiples of 10, although slightly more difficult to handle than the powers of 10 used in the former system. It is highly undesirable to mark the constant on the dial face, on account of the confusion resulting if the meter is later used with different transformers. A removable plate on cover or dial may be used to show the multiplier, this to be changed whenever necessary under supervision of the meter department.

Standardization of connections is also more important as the number of consumers' primary installations increases. Such installations are not subject to conditions of strict design as is the case in stations, and are often made by linemen and others unfamiliar with the finer points of meter work. The result is apt to be very unfortunate from a metering standpoint, particularly when the men use past experience rather than diagrams as a guide.

The remedy is, of course, to adopt a standard set of connection diagrams for all primary meters, supplying them in convenient form to be carried by all men engaged in meter installation and insisting that they be strictly followed. Under ideal conditions such meters would also be installed only by experienced metermen, but this is unfortunately impracticable in many cases. The use of instrument wire with various colored braids has also been found an excellent practice. It not only simplifies installation but is an important aid in checking out connections. Samples of diagrams that serve these purposes are shown in Figs. 1 and 2.

Testing of Primary Meters

The testing of primary meters after installation may be done in various ways, depending upon available facilities and accuracy desired. As the standard meters employed must have low voltage for their potential circuits, potential transformers are necessary in any case. These may be either the meter transformers or portable standards carried by the testers. The current for the standard meters may be obtained from the meter current transformers, from portable standards, or directly from the primary circuit—the standard meters in the latter case being connected in series with the high-voltage line.

These various methods of obtaining current and potential may be combined in any way desired, with one exception. If single-phase standards are used with current coils connected direct in the primary circuit, their potential must not be taken from the meter

secondaries, as this would place primary potential across the insulation of all meters.

The connection of single-phase standards in a primary circuit without intervening transformers, provided that proper precautions are taken, is an accurate and perfectly feasible method of testing primary meters. It eliminates corrections except for the test meters and their potential transformers. The meters should be thoroughly insulated from each other and ground, and if rotating standards are used they should be started and stopped by an independent observer for each instrument.

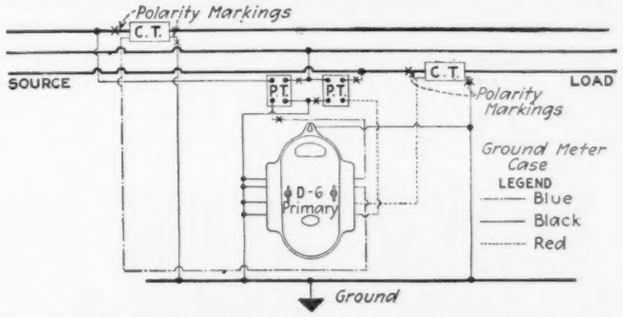


FIG. 1—SAMPLE DIAGRAM FOR SIMPLIFYING METER INSTALLATION AND AIDING CHECKING OF CONNECTIONS

Applies to a standard type of three-phase, three-wire meter requiring current and potential transformers. The black wire indicates common connection, while the red and blue wires are the phase wires.

In several instances known to the writer successful tests have been made by this method, using rotating standards on potentials as high as 30,000 volts. Each instrument was placed on a separate insulating stool with its potential transformer, the secondaries, frames and cases of meters and transformers being tied to the primary to avoid static strains. A telegraph key was included in each secondary potential circuit to start and stop the standard. These keys were manipulated by light wooden poles.

In two or three cases standards were cut in at the above voltage by men who handled the live primaries from stepladders with no protection except rubber gloves. The same men then started and stopped the test meters with ordinary pendent switches. This is by no means cited as an example worthy of emulation, and any methods involving such a hazard would certainly be prohibited to-day by the same organization. It is, however, worthy of note if only to show what risks careful men may incur and still "get away with it."

The method of cutting standards directly into a circuit of not over 2200 volts has been practiced to an extent which indicates that it is quite safe in the hands of careful, experienced men. Nevertheless, the fact that other methods offer equal accuracy with decreased risk will always militate against it, and it may be expected ultimately to fall into disuse.

If standard current transformers are cut into circuit, it will be possible to insulate these effectively and keep the high potential away entirely from the standard meters. The test may be made with entire safety without impairing its thoroughness or accuracy. The transformer insulation should be tested frequently, and during the meter calibration all secondary wiring should be grounded as a measure of precaution.

A very satisfactory home-made current transformer consists of silicon-steel laminations cut in annular form and provided with one secondary winding of any desired number of turns. On this transformer a temporary primary winding is placed, the number of turns and carrying capacity of which is determined by the load conditions under which it is desired to test. The transformer may be insulated for high voltages by the use of fiber and cambric between the primary and secondary, and the secondary may then be grounded during the test. Such insulation should always be tested just before being used by applying double the potential at which it is to operate. A current transformer of this kind, the primary winding of which is temporary and variable at will, affords the most flexible equipment for testing meters of many different current capacities, whether the voltage be high or low.

By connecting the current coils of the standards in series with those of the meter and the potential coils in parallel, all current for operating the test meters is taken from the meter transformers. This is a familiar method of testing and the only one used by many companies. Its chief recommendations are low cost, convenience and simplification of equipment. Not only are no testing transformers necessary, but the standard meters used need be rated at only 5 amp. and 110 volts. On the other hand, it must be remembered in using this method that the calibration obtained is of the meter only. No indication will be afforded of defective transformers, unless the trouble is so serious as to be practically self-evident.

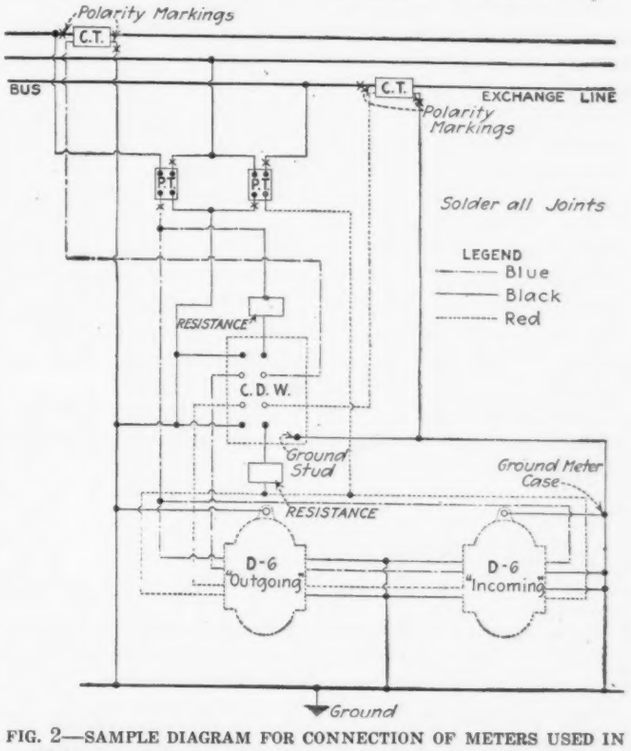


FIG. 2—SAMPLE DIAGRAM FOR CONNECTION OF METERS USED IN MEASURING ENERGY EXCHANGED BETWEEN INTERCONNECTED SYSTEMS

Two three-phase watt-hour meters and a graphic wattmeter are represented. Each meter registers in the forward direction only, being provided with a ratchet which either prevents backward rotation of the disk or disengages the registering mechanism under such conditions. With the connection shown, the left-hand meter will register all "outgoing" and the right-hand meter all "incoming" power. The graphic instrument has a central zero mark and is preferably of 10-amp. capacity or at least so designed that full-load current on the current transformers in either direction will not cause it to exceed the scale limits. The simplification of this diagram as compared with one requiring individual connections between all meter and transformer terminals is quite evident.

If it is known before installation that subsequent tests are to be made by the secondary method, the

meter should receive a previous calibration in the laboratory, where it is tested as a unit with its transformers. It should be adjusted as close to correct as possible from light to full load and from unity power factor to the lowest likely to occur in service. The meter should then be disconnected from its transformers and tested independently, the results being embodied in a curve to which the meter is adjusted on all subsequent service tests. Care must be taken that the meter is installed on the same phase rotation as used when calibrated.

All of the methods previously discussed are based on the assumption that the consumer's running load is used in making the service test. A close calibration at varying loads and power factors is usually impossible under such conditions. If such a test is desired, the meter and its current transformers should be disconnected from the line and a suitable artificial load at 110 volts applied through the transformer primaries, with reactors or phase shifters to vary the power factor. Corrections for the potential transformers may be made from their previously determined characteristics. Such a test practically amounts to a laboratory calibration, even if made on the consumer's premises. Whether the increase in accuracy warrants its use must be determined by individual conditions.

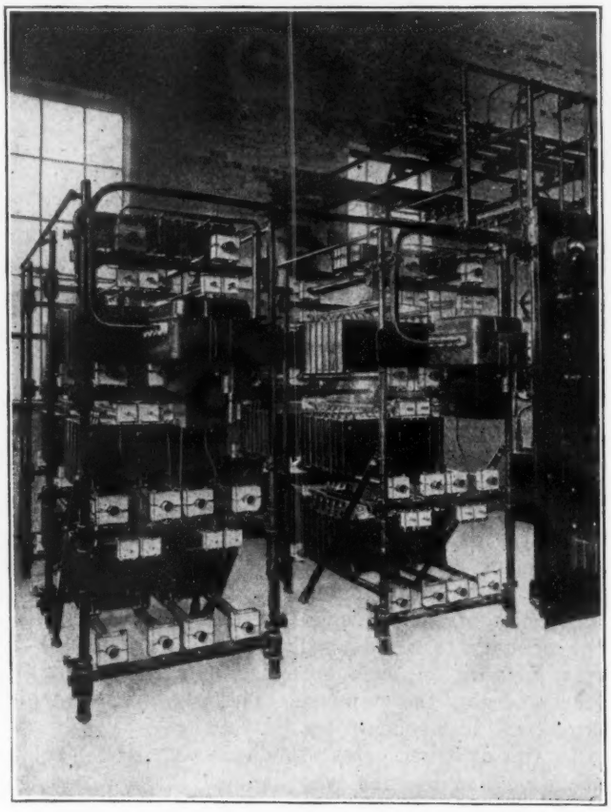
Whatever method of testing is used, it is always advisable to provide means of opening the primary circuit at suitable points for the insertion of test apparatus. This is particularly the case if it is necessary to test without interrupting the service. For voltages not exceeding 2200 a pair of receptacles for plugs in series with each current transformer and connected by a removable link form a very satisfactory means of cutting in testing instruments. A less expensive device consists of a pair of lugs such as are used for transformer terminals, bolted together and placed in series with the line. The tester clamps his leads on either side of the lugs and removes the bolts. Such lugs should never be of the interleaved variety, as an attempt to separate them on an energized circuit without disturbing test connections is both difficult and dangerous.

A SUCCESSFUL STATIC CONDENSER INSTALLATION

By This Means Brockton Edison Company Effects a Line-Loss Saving of 235,000 Kw.-hr.— Voltage Regulation Improved

By the installation of static condensers which cost $7,500 in place, the Brockton Edison company has relieved its transmission lines to Stoughton, Mass., from overload, has effected an annual saving estimated at $2,800 and improved the voltage regulation at the Stoughton substation. The company was faced with the problem of meeting increasing loads for essential industries in the vicinity of Stoughton and the feeders in these sections were already loaded to capacity. The load was about 750 kw. at a power factor of 65 per cent to 70 per cent. It was made up of a considerable number of small installations, all within a radius of two miles (3.2 km.) and within one mile (1.6 km.) from the Stoughton substation.

This station was supplied by a three-phase transmission line about 12 miles (19 km.) long and operating at 13,200 volts, 60 cycles. The line consisted of three No. 4 wires, and the construction was overhead through most of the distance, but a mile and a half of it was underground. The underground section very definitely limited the carrying capacity of the line due to the possibility of danger from overheating. The problem was therefore how to supply this increased load with facilities at hand. The only means seemed to be an improvement of power factor. Such an improvement would reduce the current flowing in the line and thereby cut down both the voltage drop and the transmission losses.



FRONT VIEW STATIC CONDENSER AND CONTROL APPARATUS, STOUGHTON SUBSTATION

A survey of the locality revealed the fact that no customers' installations appeared to offer the advantageous location of synchronous motors, and no changes in customers' premises seemed possible which would raise the power factor of the central station sufficiently to help in solving the problem.

ADVANTAGES OF STATIC CONDENSERS

In considering the choice between the synchronous condenser and static condensers located at the substation, the static condensers were decided upon owing to many advantages which were anticipated. The static condensers could be set up without a special foundation and placed in such relation to the switchboard that the wiring problem was a simple one. The condensers needed no attention other than connection or disconnection from the line. They required no maintenance as there are no wearing parts. The losses, however, were guaranteed to be less than 1 per cent. The construction was such that the condensers could easily and cheaply be disassembled and assembled again in some other location.

The chief drawback to the use of static condencers appeared to be the fact that the corrective effect cannot be readily changed according to changing loads. This disadvantage was partially overcome by ordering the desired capacity in two units, thereby allowing the connection of either one-half or the whole capacity as desired.

Two sets of 200 kva. each were therefore installed. The result may be briefly stated as follows: The load varied from 700 kw. to 780 kw. Without the condenser the average power factor was 70 per cent, giving 1,057 kva. with a voltage of 12,400. The connection of the condenser raised the power factor to 90 per cent, giving 822 kva. with a voltage of 12,850. These results checked very closely with the original calculations. The annual savings in transmission-line losses are estimated at 235,000 kw.-hr. The financial aspect of this installation may be roughly shown as follows:

Cost of 400-kva. capacity	$7,200.00	
Expense of transportation and installation	300.00	
Cost of set installed		$7,500.00
Annual fixed cost, 15 per cent		1,125.00
Increased capacity made available in Stoughton, 300 kw.		
Value of capacity, 300 kw. at $50 per kw. ($50 per kw. taken as the cost of transmission and conversion investment.)		15,000.00
Annual fixed cost, 15 per cent		2,250.00
Reduction in losses, 225,000 kw.hr.		1,687.50
Annual saving		3,937.50
Annual cost		1,125.00
Net annual saving		2,812.50

This static-condenser installation was described in an article by W. A. Forbush in the *Stone & Webster Journal*, March, 1919.

Data on Lamp Operation and Maintenance

Records Are Kept Which Show the Life of All Lamps Used in Park System—Faults in Supply Apparatus Are Detected by Lamp Records—Data Indicate that Life of Lamps Depends Greatly on Switching in Circuit

BY C. H. SHEPHERD
Electrical Engineer, Commissioners of Lincoln Park, Chicago.

IN THE operation and maintenance of street-lighting systems employing large, high-efficiency units it is essential that adequate operating records be kept of all units installed, both for checking the guaranteed life of the lamps and for determining the engineering data applying to these units under actual service conditions. Individual lamp records may lead to the detection of faults in compensators or transformers which, unnoticed, would rapidly destroy the lamps. Data thus far obtained by the writer indicate an unexpected curtailment of lamp life due to normal switching in the lamp circuits.

To keep these records requires close coöperation between the maintenance and operating departments, but by proper systematizing the operation of the record system becomes to a large extent automatic, requiring only that each man keep up his particular part of the records. This, if it is properly done, takes only a very small part of each man's time. The separate parts of the records, while each is made out by a different man, may be so interlocked and correlated that at the end of each month or year, as the case may be, the recapitulation of all the records requires a very short time.

Extensive Use of Lamps

Such a system has been evolved for the electrical department of the Commissioners of Lincoln Park, Chicago. This organization supplies power, light and water to the entire Lincoln Park system, comprising six parks —namely, Lincoln, Lake Shore, Seward, Stanton, Hamlin and Welles—with a total area of 630 acres (250 hectares) and with about 22 miles (35 km.) of boulevards, including the world-famous Lake Shore Drive and Sheridan Road. The outside lighting requires at present 1561 gas-filled tungsten 400-cp., 15-amp. lamps, operating on eighteen series, 60-cycle, 7.5-amp. circuits, each with its individual transformer and regulator. Special outside lighting requires about 300 special multiple, large-sized units and floodlamps from the 1000-watt size down, while the inside lighting comprises some 6500 outlets of various sizes. The series lighting was at one time accomplished by arc lamps, but this has now been changed. Since then the results obtained from the incandescent units have amply justified the change, because savings in operating costs since 1914, when the changes were begun, have paid the cost of the substitution several times over. The records published here cover four years of actual operation since that time.

System of Recording Lamp Data

When lamps are received from the factory they receive an individual test, and all defective lamps are rejected. The good ones are placed in storage and are drawn out as they are required for replacements.

When a lamp is placed in service it is designated by the location of the particular standard on which it is placed and is noted on a record card (Fig. 1). On the face of this card is recorded information covering the location, circuit, make, size, filament and principal dates of the installation, while on the back of the card are recorded the electrical data on the compensator or transformer serving this particular lamp, including the ratio of transformation of the unit, the primary reactance, etc. This card is held on file until the lamp burns out or is replaced for any other reason, at which time the closing entries are made on the card.

The burn-outs are recorded on the outage report (Fig. 2), which is filled out daily, first by the patrolman, who records the outage, and later by the trimmer, who records the replacement. These records are made out in duplicate, the original remaining on the operator's file, the copy being taken out in the morning by the trimmer and returned in the evening as part of his daily report. From this report the operator completes the filling out of the record card, after obtaining the data on the life of the lamp.

The figures covering the data on the life of the lamp naturally depend on the daily length of run of the cir-

cuit on which the lamp is operating. The length of run in turn depends on the time of cutting in and cutting out the circuit each day. This time is entered each day on the daily substation load record, together with such other data as may affect the operation. From this record the daily length of run is entered on the monthly trimming schedule. From the first to the last day of each month the daily length of run is recorded and a progressive total is carried through for each month on the length of run of each particular

POST No. 1 2nd lamp west of High St. N. S. Diversey TYPE "C" RECORD L. 29

MAKE	SIZE	FILAMENT	LOCATION	INSTALLED	BURNT OUT	HOURS RUN
W.H.	400 C.P.	- 1 -	Div.Pk.Way	9-11-15	2-4-16	1740
"	"	"	"	2-5 -16	5-18-16	852
"	"	"	"	5-19-16	1-2-17	1965
W.E.	"	"	"	2-3-17	3-4-17	800
W.H.	"	"	"	3-5-17	7-5-17	1169
"	"	"	"	7-6-17	3-2-18	2400
"	"	"	"	3-3-18	8-19-18	672
"	"	"	"	8-20-18	1-9-19	804
Col	"	"	"	1-10-19		

E. H. Shelhamer

573 ELEC. ENGR. IN CHARGE

FIG. 1—RECORD CARD GIVING INFORMATION CONCERNING LAMPS AT GIVEN LOCATION

circuit. Knowing the date of installation of any lamp and the length of run of its circuit from that date to the time the lamp is renewed, month by month and also daily, it is apparent that it is a comparatively simple matter to figure up the life of any lamp.

The date of renewal and the life of the lamp in hours are then entered on the lamp card, together with the data on the replacing lamp, after which the whole process starts all over again.

VALUE OF RECORD FOR EACH INDIVIDUAL LAMP

While these processes may at first appear to be more or less complicated, still the operation of any system becomes a matter of routine as the men doing the work become more accustomed to it, and it has been found that the recording of the performance of each and every lamp, compensator and transformer often results in the discovery of irregularities which would otherwise result in serious losses and which might run on indefinitely without being found out. The equipment necessary to carry on such a system costs very little; the time required to carry it on is dovetailed into the work of the various men in such a way that their other duties are not affected, and the results obtained more than justify the expenditure incurred, from any point of view.

In order to illustrate the nature of the life data obtained from the actual workings of this system, there is presented here a monthly summary and the progressive totals covering the number of lamps used, the corresponding lamp-hours and the average lamp life in hours. The various makes of lamps are designated by the letters A, B, C, D and E. From an inspection of the various figures it is evident that the presentation of these data in graphical form would show a number of points which might serve to further the analysis of the data. Since the lamps in question have been operated on circuits running all night, or approximately 4000 hours per year; half night, or about 2200 hours per year, and alternate, or about 3100 hours per year, all ordinary conditions of operation are represented, all of which tends to maintain a true average. The record of lamp-hours during any given period supplies a stable basis in the determination of unit costs. Knowing the cost per lamp, the calculating of unit material and total costs is facilitated.

The keeping of apparatus records in conjunction with the lamp records offers an easy method of checking the

LIFE DATA FOR INCANDESCENT STREET LAMPS—FIVE DIFFERENT MAKES—LINCOLN PARK, CHICAGO

	A		B		C		D		E	
	No. Lamps	Average Life	No. Lamps	Average Life	No. Lamps	Average Life	No. Lamps	Average Life	No. Lamps	Average Life
1915	158	1454	299	1185						
1916	546	2924	1020	1555	87	296				
1917	543	3560	768	1251	1490	987				
1918	108	6102	2218	1276	346	2651	14	4614	126	1279
Total, 1915-1918	1355	3261	4305	1333	1923	1252	14	4614	126	1279

Total number lamps to date	7,723
Average life in hours	1,662

performance of this apparatus and provides a sure and ever-present indication of any trouble occurring—or, in many instances, on the point of occurring—on such equipment.

AN INTERESTING DISCOVERY

An interesting point which was discovered in analyzing the life records is that in a preponderant number of cases lamps installed on the same date, on circuits operating all night, half night and alternate, will not give the same life but will burn at approximately the same date. This would seem to indicate that the life of a lamp operating under these particular conditions depends to a large extent on the number of times the

THE COMMISSIONERS OF LINCOLN PARK
ELECTRICAL DEPARTMENT
DAILY TYPE C. LAMP OUTAGE REPORT DATE Jan 4 1918

CIRCUIT	TYPE & FIL OF LAMP BURNED OUT	TYPE & FIL OF LAMP ON	DATE OF BURNED OUT LAMP INSTALLED	LIFE OF BURNED OUT LAMP	LOCATION
B52	W E A	W E A X	1-4-18	Defective	1 N. Wayeland E. S. Sher Rd
B38	" " "	" " " X	10-27-17	966	3 N. Hawthorne E S " "
B1	W E V	" " " X	8-22-17	1727	N Lamp Concrete Pl. triangle
G36	W E A	" " " X	11-9-17	843	Arlington & Lake View
G27	W E I	" " " X	12-12-17	331	W of bear pit

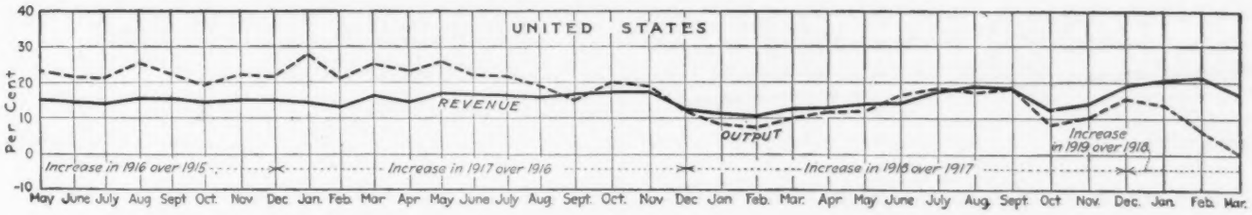
FIG. 2—OUTAGE RECORD FOR DETERMINING LAMP LIFE

Reverse side of card states that lamps operated from compensator No. 2331, which on test showed 7.5 amp. primary and 15 amp. secondary current, giving an accurate ratio at a load of 256.5 watts.

lamp in question is cut in and cut out—to a greater extent perhaps than on the number of hours of actual operation.

Records of this nature are capable of extensive analysis. The fact that these records are taken from actual operation, under any and every kind of operating condition, makes them especially valuable as an adjunct to the results which are obtained in the experimental laboratory.

Central Station March Operations


UNITED STATES
REVENUE
OUTPUT
Per Cent
40
30
20
10
0
-10
Increase in 1916 over 1915
Increase in 1917 over 1916
Increase in 1918 over 1917
Increase in 1919 over 1918
May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar

CURTAILMENT IN INDUSTRIES CAUSED A SLIGHT DECLINE IN OUTPUT, BUT REVENUE CONTINUED TO GAIN

CURTAILMENT in industries in March affected the returns of central stations for that month. Reports received by the ELECTRICAL WORLD from central stations representing 52 per cent of the industry show a slight decrease in output as compared with March of the preceding year. The reduction is but 0.1 per cent, and of course it may be altered by the full returns from the larger proportion of the industry usually represented in the compilation. One-tenth of 1 per cent is insignificant. In total sales aggregating 1,200,000,000 kw.-hr. a fraction of 1 per cent does not mean much alteration in volume of output. The demand upon central stations is still enormous, and it will grow in spite of any momentary halting due to inactivity in industries here and there.

The cessation of war preparations meant necessary changes in industries, in many cases abrupt. Plants which had been operating under pressure to turn out materials for the war could not be converted over night into peace-time enterprises. Some of the large central-station properties showed decreases in February as a result of the lack of markets for the output of their heaviest consumers of energy. Others had a lessening of demand that foreshadowed possible reduction. Since the development of these changes little if any improvement has taken place in such industries as copper and iron and steel. It is evident that recession went still further in these or in other industries in March.

It is a great source of strength to the central-station industry as a whole that its service is rendered to all industries. Though its output is therefore in proportion to the entire industrial activity of the nation, its service is just as adaptable to the approaching stupendous needs of peace as it was for the war.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Per-centage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1918	1917	Per Cent Increase	1918	1917	Per Cent Increase
Apr.	60	$25,864,000	$22,966,000	12.6	1,450,221,000	1,294,561,000	9.4
May	62	25,365,000	22,426,000	13.1	1,537,527,000	1,297,843,000	11.5
June	60	26,070,000	22,599,000	15.3	1,531,099,000	1,372,935,000	11.9
July	56	21,935,000	18,559,000	18.2	1,370,461,000	1,319,444,000	16.0
Aug.	61	26,891,000	22,690,000	18.5	1,647,510,000	1,156,692,000	18.5
Sept.	60	28,051,000	23,810,000	17.8	1,579,149,000	1,417,150,000	16.3
Oct.	56	26,254,000	23,228,000	13.0	1,517,866,000	1,348,820,000	17.0
Nov.	57	29,883,000	25,894,000	15.4	1,528,836,000	1,392,359,000	9.0
Dec.	56	32,058,000	27,128,000	18.1	1,539,161,000	1,383,747,000	10.5
		1919	1918		1919	1918	
Jan.	57	33,294,000	27,589,000	20.6	1,522,660,000	1,369,542,000	12.3
Feb.	54	28,130,000	23,162,000	21.4	1,249,806,000	1,157,275,000	7.9
Mar.	52	25,027,000	21,392,000	16.9	1,207,373,000	1,208,683,000	—0.1

While output showed a slight decline, revenue for March continued to maintain an increase. The gain of 16.9 per cent in revenue is the logical outcome of rate increases made to offset the higher cost of production. Electric utilities need to be financially strong in order to borrow the capital they need for expansion.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States			Atlantic States			Central States			Pacific and Mountain States		
		Percentage of Industry Represented	1918	1917	Per Cent Increase	Percentage of Industry Represented	1918	1917	Per Cent Increase	Percentage of Industry Represented	1918	1917	Per Cent Increase	Percentage of Industry Represented	1918	1917	Per Cent Increase
REVENUE	April	62	$2,890,000	$2,578,000	12.1	59	$10,054,000	$8,946,000	12.4	53	$8,431,000	$7,103,000	18.7	84	$4,489,000	$4,339,000	3.5
	May	62	2,810,000	2,530,000	11.5	64	9,929,000	8,613,000	15.3	53	8,217,000	6,956,000	18.1	83	4,805,000	4,327,000	12.0
	June	63	2,925,000	2,584,000	13.3	63	10,048,000	8,761,000	14.7	49	8,124,000	6,824,000	19.0	84	4,973,000	4,432,000	12.2
	July	62	3,037,000	2,511,000	20.9	62	9,278,000	7,961,000	16.5	42	4,998,000	4,116,000	21.4	88	4,622,000	3,971,000	16.4
	Aug	63	3,138,000	2,585,000	21.4	63	10,147,000	8,722,000	16.3	51	8,223,000	6,823,000	20.5	85	5,383,000	4,560,000	18.0
	Sept	64	3,268,000	2,811,000	16.2	57	10,143,000	8,631,000	17.5	51	9,251,000	7,703,000	20.1	86	5,389,000	4,665,000	15.5
	Oct	63	3,360,000	3,036,000	10.6	51	8,822,000	7,924,000	11.3	50	9,218,000	7,848,000	17.4	81	4,854,000	4,420,000	9.8
	Nov	64	3,695,000	3,238,000	14.1	55	11,877,000	10,400,000	14.2	50	9,277,000	7,704,000	20.4	81	5,034,000	4,552,000	10.6
	Dec	64	4,097,000	3,449,000	18.7	55	11,927,000	10,199,000	16.9	50	10,781,000	8,836,000	22.0	79	5,253,000	4,644,000	13.1
			1919	1918			1919	1918			1919	1918			1919	1918	
	Jan	63	4,253,000	3,443,000	23.5	60	13,444,000	11,168,000	20.3	47	10,410,000	8,484,000	22.7	77	5,187,000	4,494,000	15.4
	Feb	63	3,895,000	3,048,000	27.7	53	10,894,000	8,943,000	21.8	45	9,305,000	7,484,000	24.3	73	4,036,000	3,618,000	11.5
	March	63	3,573,000	3,008,000	18.7	52	9,856,000	8,666,000	13.7	40	7,737,000	6,330,000	22.2	75	3,861,000	3,388,000	13.9
KW.-HR. OUTPUT			1918	1917			1918	1917			1918	1917			1918	1917	
	April	62	117,416,000	101,888,000	15.2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11.4	84	399,126,000	372,465,000	7.1
	May	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12.3	53	441,202,000	404,560,000	9.0	83	462,372,000	406,797,000	13.6
	June	63	125,809,000	103,292,000	21.8	63	527,773,000	461,396,000	14.4	49	423,439,000	366,382,000	15.5	84	454,078,000	388,374,000	16.9
	July	62	135,960,000	105,373,000	29.0	62	518,566,000	439,464,000	18.0	42	254,189,000	216,296,000	17.5	88	461,746,000	395,559,000	16.7
	Aug	63	143,566,000	114,017,000	25.9	63	567,672,000	490,505,000	15.7	51	447,829,000	399,278,000	12.1	85	488,433,000	413,350,000	18.1
	Sept	64	133,901,000	114,279,000	17.1	57	520,312,000	445,154,000	16.8	51	471,594,000	408,320,000	15.5	86	453,342,000	381,067,000	18.9
	Oct	63	139,784,000	128,970,000	8.3	51	481,222,000	440,268,000	9.3	50	479,990,000	442,054,000	8.5	81	416,870,000	381,067,000	9.4
	Nov	64	138,559,000	123,033,000	12.6	55	542,699,000	495,812,000	9.4	50	444,012,000	396,665,000	11.9	81	403,566,000	368,237,000	9.6
	Dec	64	145,543,000	129,838,000	12.1	55	475,253,000	421,973,000	12.6	50	489,864,000	443,544,000	10.4	79	428,906,000	374,187,000	14.6
			1919	1918			1919	1918			1919	1918			1919	1918	
	Jan	63	143,254,000	124,632,000	14.9	60	525,322,000	458,545,000	14.5	47	463,394,000	403,127,000	14.9	77	390,690,000	371,156,000	5.2
	Feb	63	128,660,000	109,993,000	17.0	53	406,702,000	374,958,000	8.4	45	426,965,000	378,912,000	12.6	73	287,479,000	293,492,000	—2.0
	March	63	123,044,000	121,248,000	1.4	52	384,605,000	396,850,000	—3.1	40	389,379,000	375,200,000	3.6	75	310,345,000	315,385,000	—1.6

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PRIMARY CONNECTIONS MADE WITH IRON PIPE

Hog Island Substation with Capacity of 24,000 Kva. Is One of Many Built in War Time and Found Satisfactory

The 24,000-kva., 66,000-volt outdoor substation at Hog Island is one of the many substations built during the war in which iron-pipe conductors are used. In that installation all primary connections except those to transformer terminals were made of iron pipe. Other companies in different parts of the country used iron pipe for high-tension busbars and for primary connections in substations. The practice has proved so satisfactory that many companies are continuing to use iron pipe for these purposes, though the war restrictions on the use of copper have been removed. The iron buses on outdoor substations are usually galvanized.

BOILER-SCALE PREVENTION

Pounds of Coal Wasted per Ton Fired with Boiler Scale of Different Thicknesses

Professor Schmidt of the University of Illinois has conducted an extensive investigation into the decrease in boiler efficiency due to scale, with these results:

TABLE I—EFFECT OF SCALE ON BOILER EFFICIENCY

Character of Scale	Average Thickness of Scale in In.	Composition of Scale	Loss of Efficiency, Per Cent
Hard	1/50	Mostly carbonate	5.4
Soft	1/32	Mostly carbonate	7.2
Hard	1/32	Mostly carbonate	8.5
Soft	1/25	Mostly carbonate	8.0
Hard	1/25	Mostly sulphate	9.3
Hard	1/20	Mostly sulphate	11.1
Soft	1/16	Mostly sulphate	10.8
Soft	1/16	Mostly carbonate	11.0
Soft	1/16	Mostly carbonate	12.4
Hard	1/16	Mostly carbonate	12.6
Soft	1/11	Mostly carbonate	15.0
Hard	1/9	Mostly sulphate	15.9

The first thin layer of scale was found to be the most injurious, because the insulating effect varies as the square root of its thickness. To show the loss due to the insulating qualities of the scale, in terms of coal, Table II has been compiled.

Instead of allowing scale to form, however, engineers endeavor to eliminate the scale-forming elements before the water enters the boiler. The use of boiler compounds helps conditions, but they seldom, if ever, accomplish really satisfactory results. If the compound is a chemical and reacts on the scale-forming material in the water, it may be expected to change this material into what is commonly known as sludge. When this occurs the sludge is deposited on the boiler heating surfaces as a soft mudlike substance which is not scale but which has an insulating effect and which, if excessive, may actually result in burning the plates of the boiler. To avoid its becoming excessive the boiler is blown down frequently, which causes a direct loss of heat and waste coal.

The ideal condition is perfect cleanliness, and after figuring the losses due to scale and the cost of removing it the treatment of the feed water seems the logical solution in most cases. An investigation of the cost of proper water treatment generally points to its being a very profitable investment, even when the water is as pure as that obtained from Lake Michigan.

TABLE II—COAL WASTED BY BOILER SCALE

Average Thickness of Scale in Inches	Coal Lost from Every Ton Fired, Lb.	Average Thickness of Scale in Inches	Coal Lost from Every Ton Fired, Lb.
1/50	100	1/16	220
1/32	140	1/11	300
1/25	180	1/9	320
1/20	200		

COILS OF TRANSFORMERS CLEANED AFTER REPAIRS

An Arrangement Devised for Giving Coils a Bath of Hot Oil to Remove Foreign Substances Before Reassembling

After making some repairs on the primary and secondary coils of a 5000-kw., 100,000-volt transformer at one of its substations, the Union Electric Light Company of St. Louis devised a scheme of washing the coils before they were placed back in the case. Strong timbers, measuring about 4 in. by 4 in. (10 cm. by 10 cm.), were used to clamp the coils in a permanent position to permit their being handled without injury. The coils were then suspended from a crane hook at such angle that oil would flow through from one end of the coil assembly to the other and wash the exposed surfaces. The crane held the coils about 10 ft. (3 m.) above the floor and the oil which was poured in at one end was collected in a suitable receptacle when it came out at the other end.

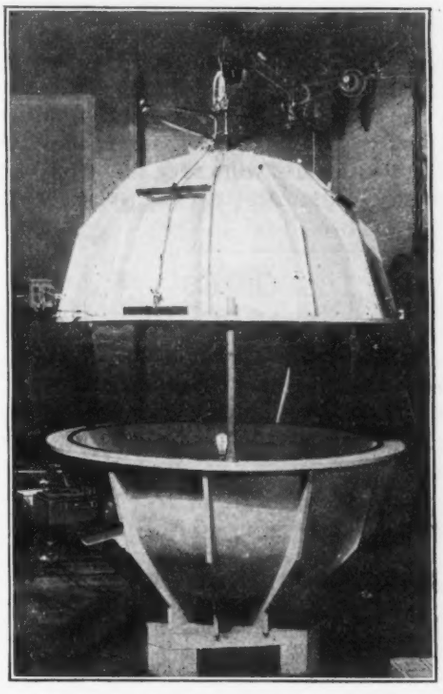
The oil-circulating outfit consists of a heater and a filter press. The heater, which was a 1000-watt inclosed-wire oven unit connected to a 110-volt circuit, was placed in the oil tank. This kept the oil hot while it was being circulated. The oil coming from the press was run through the coils, and as it came out was collected in a tarpaulin which was arranged to serve as a half funnel to drain the oil into a 50-gal. steel oil drum with the head knocked out. This arrangement is said to have worked successfully in removing foreign matter from the coils.

HOME-MADE PHOTOMETER SAVES MONEY FOR UTILITY

Spherical Photometer, Built Under Supervision of Utility Lighting Department Officials, Satisfactory in Operation

A spherical photometer 5 ft. (1.5 m.) in diameter was recently designed and built by the Hartford (Conn.) Electric Light Company, under the supervision of Harry L. Thomson, head of the lighting department, and H. J. Blakeslee. The cost of building this photometer was $425, compared with market quotations of around $700 for equipment of the same size.

A special feature of the photometer is its horizontal subdivision into two halves, the upper half being arranged for raising and lowering by a ¼-hp. motor in about twelve seconds. The photometer can be easily controlled by one observer seated beside the lower rim. A reversing switch mounted below the rim stops the motor and enables the upper half to be held at intermediate positions if desired. A Sharp-Millar photometer is mounted on the upper hemisphere so that the eyepiece of the telescope is brought to a convenient height when the sphere is closed on a felt pad 0.125 in. (3-mm.) wide and 0.25 in (6-mm.) thick.



FIGS. 1 AND 2—PHOTOMETER AND ADJUSTABLE HOLDER FOR LAMP

The combination lamp standard and conductor lead rack (right) is adjustable for purpose of centering lamps in sphere. Upper half of complete photometer (left) is raised and lowered by ¼-hp. motor, which is shown with limit switch, etc., on ceiling. The Ford automobile spring absorbs the shock to the top section when stopping at upper limit. Measuring instruments for photometer are to the left of the picture.

The hemispheres were built up by interconnecting 5-in. by 0.875-in. (127-mm. by 22-mm.) pine ribs with wire lath and plastering the latter to a thickness of 1.25 in. (32 mm.). The inside was given two or three coats of white lead paint. The surfacing was accomplished by rotating a wooden quadrant with a metal cutting edge about the axis of the sphere and great care was taken to produce a smooth surface. The wooden framing is supplemented by four sets of 1.5-in. by 1.5-in. by 0.125-in. (38-mm. by 38-mm. by 3-mm.) angle-iron cross-braces tied to the supporting top by 0.312-in. (8-mm.) stranded copper cables. The upper hemisphere weighs about 300 lb. (136 kg.), is counterbalanced by a cylinder filled with sand and travels vertically through 28 in. (71 cm.) The axial lamp standard consists of four brass rods terminating in spiders at top and bottom. The test-lamp base is supported on a piece of piping adjustable up and down in the spider ring to center different sizes and types of lamps properly.

HANDLING EMERGENCIES AND PROFITING BY EXPERIENCE

A Few Reminders That May Not Be Amiss, and Suggestions of Information That Should Be Collected Immediately After Disturbance

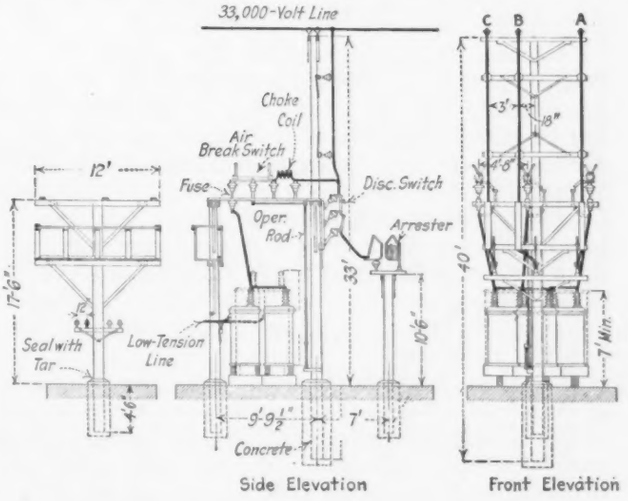
When trouble occurs the operator should take time to think, decide what he is going to do, and do it quickly and accurately. He must not be influenced by alarming reports of inexperienced persons or those not connected with the operation. Operating attendants should, when not engaged in other matters, try to anticipate the effects of different trouble and decide beforehand what to do under such emergency conditions.

After a disturbance on the system or an interruption of service the following information will be required:

Exact time of interruption, load in kilowatts at that time, nature of interruption (state whether total or partial loss of load or simply disturbance unaccompanied by loss of load), nature of trouble (state whether ground, short circuit or open circuit and on what part of system), cause of trouble if known, details of action of relays in station, details of all switching done in trying out and restoring service with time noted, particulars of connections used in restoring service, cause of delays if any, damage if any to apparatus in station and suggestions which may prevent future trouble.

Pole-Type Substation Used for 33,000 Volts

The illustration shows a recently standardized 33,000-volt outdoor substation in which the supporting structure consists of only one line pole and one stub. The dimensions allow for the use of three 150-kva. transformers, but by increasing the height and placing the poles further apart this station can be made to accommodate transformer installations up to 600 kva.



CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

THE COMPARATIVE COST OF ELECTRIC LIGHTING

Small Expense of Lighting a Household as Contrasted with Other Costs in These Days Pointed Out by H. W. Peck

In these days of high living cost comparisons of electric lighting expense with other items in the household budget make a strong case for the central station. H. W. Peck, vice-president and general manager Schenectady Illuminating Company, in a recent interview in the Schenectady *Gazette*, pointed out that during the last year the average bill of lighting customers, exclusive of the business section, was $1.98. He compared this with various commodity costs as follows:

Commodity	Yearly Bill	Daily Average Cost
7 tons of coal at $10 per ton	$70.00	$0.192
Milk, 1 qt. a day	54.75	.15
Bread, one loaf a day	47.45	.13
Car fare, two trips daily per family	36.50	.10
Telephone	30.00	.082
Ice, twenty-four weeks, 150 lb. a week, 80 cents per 100 lb	28.80	.171*
Electric service	22.67	.062

* The daily cost of ice is calculated on the basis of days refrigeration is used.

Mr. Peck also gave the average cost of appliances per month, determined by special meter installations or by calculation, as follows: Electric iron, 50 cents; electric toaster, 40 cents; electric washing machine, 50 cents; electric mangle, 50 cents; electric vacuum cleaner, 25 cents; electric range, $4.

ADVERTISING VALUE OF SOCKET DEVICES

Even Though Requiring Only Small Amounts of Energy, They Help to Teach the Public to "Do It Electrically"

In considering central-station sales policies the wisdom of pushing particular lines of socket devices is sometimes questioned. The value of appliances requiring inputs of hundreds of watts each or utilized for protracted periods at fairly regular intervals is seldom disputed. When one comes to the class of equipment driven by fractional-horsepower motors and used intermittently, or consuming for stationary service of some sort anywhere from a few watts up to 50 or 100, some hard-headed director is likely to put the question, "Why waste effort on apparatus of such modest earning power at the meter?"

The answer is not far to seek. The advertising value of electrical methods, even in such small devices as automobile radiator warmers, pencil sharpeners, bell-ringing transformers, electric clocks and numerous other conveniences of low revenue yield on the monthly bill, is very large. It is probably impossible to estimate accurately the missionary work which such appliances accomplish when in service. They give point to the slogan "Do it electrically," and arouse the interest of the public which comes in contact with them as most other means of exploitation cannot.

Passing to bulkier devices, the same thing is true. While washing machines and vacuum cleaners, for example, are small consumers of energy, it is advisable to push their sale, because many such devices installed on a single system create a desirable total kilowatt-hour output and by saving their users genuine physical weariness develop a good will toward things electrical which is of immense value. Where such equipment is distributed to the public at the full retail price, the central station takes advantage of the fact that the greater profit from such sales will carry the expense of selling larger energy consumers but smaller profit-per-sale devices.

RATE EXPERT DISCUSSES FUTURE OF EMERGENCY RATES

Until Readjustments in Cost Take Place, Commissions Are Justified in Maintaining Temporary Relief Measures for Indefinite Period

"What constitutes the so-called war emergency in utility rate matters has been a subject for wide divergence of opinion, and the measure of relief afforded is as variable as the range is wide," said E. F. McKay, rate expert for the Empire Gas & Fuel Company, speaking before the Oklahoma Public Utilities Association. The Georgia commission, considering a rate appeal, said: "If, because of war, the operating expenses of a public utility are increased to such an extent (with reasonable certainty that still further increases are inevitable) that after paying the same the remaining revenues are insufficient to provide for the reasonable preservation of the property in use, the payment of government charges, such as taxes, public improvement assessments, interest on lawfully issued bonds, contractual obligations such as reasonable rental for property used and necessary in its business, but not owned, and such a reasonable return upon owned property in use as will sustain its credit, a combination of such circumstances exists which calls for immediate action or remedy." And then this commission added: "It follows that when such a combination of circumstances no longer exists the necessity for emergency relief ends. Emergency rates, therefore, should be temporary and only for the period of abnormal conditions which necessitates them."

"Several commissions have attempted to forecast the probable duration of war conditions," continued Mr. McKay, "and have been so sure of the accuracy of their respective forecasts as to limit the effectiveness of relief orders in accordance therewith. The period forecast varies in different jurisdictions from sixty days to three years." Mr. McKay added:

The Missouri commission in numerous cases limits effectiveness of emergency rates to one year. Nebraska last

summer thought six months would see the emergency over for telephone companies. New Hampshire saw the same period of emergency for electric utilities, while Oregon considered the six-month emergency period correct but applied it to gas utilities. Indiana thinks two years sufficiently soon to expect recovery. Pennsylvania, in a telephone case, puts the emergency at three years and in a water case says war costs will prevail for several years thereafter. California says all war-time rates are abortive and indicates a discreet disinclination to going on record. A majority of the states, including Oklahoma, have made emergency rates effective indefinitely. The advances in these states are permanent unless or until the new rates are challenged and, on order after hearing and due showing, superseded.

If it were true that an automatic readjustment of conditions constituting the war emergency could have been expected with cessation of fighting in Europe, the time limit or rate and other relief measures would have been logical, but with the impossibility of such readjustment, either automatic or otherwise, until cost of fuel, transportation of fuel, supplies and transportation of supplies, and cost of labor shall have resumed a normal level, assuming pre-war costs to be normal, it is clear that there cannot be a revision to pre-war rates without injustice to the utilities and impairment to the public interest

CENTRAL-STATION POLICY ON UNDESIRABLE LOADS

Business Should Be Taken Desp'te Its Nature if Central Station Is to Fulfill Its Functions—Ultimate Results Beneficial

BY C. I. CRIPPEN*

The modern central station has a very definite function to perform in its territory; namely, to serve with its product all those who have need for such a commodity. It is granted by leading operators that the future prosperity of the central-station companies lies in carrying out this ideal by increasing the use and density of business within a given area. In practically all communities one of the larger fields, if not the largest, of load is industrial business, lighting, motor service and electric heating, including welding. It follows then that if the plants are to progress toward their ultimate goal, the loads that are available must be taken care of. This naturally includes the industrial load, a part of which is the electric welding load. Some of this welding business is not particularly attractive in itself, and central-station companies would not care to load up their plant with it; but it is a minor part of the industrial load, so it is very good policy to include the whole load, thus doing the things for which the central stations are in business.

It often happens that service for welding installations offers the entering wedge into a plant which it has been impossible to place on the line. Given this start, the alert commercial man will enlarge the opportunity as occasion permits, until with good service and fair treatment the entire plant is being supplied. Take the case of a manufacturer operating a direct-current plant for motors and light. He sees that the installation of a spot welder will eliminate a riveting operation with an apparent decrease in cost and an improved product. He requires alternating current to run the welder. The central-station company might be loth to take the business on account of its low load factor, poor power factor and low earning power. However, it would be wise to accept the business of the welders, then night lighting may follow, then a few motors may be put on, and later the whole plant load may be taken over, making a valuable addition to the central-station load.

*This information was presented by Mr. Crippen before the Ohio Electric Light Association at Youngstown, Ohio.

STATEMENT OF THE RATE SITUATION IN ILLINOIS

Public Utilities Commission in Its Defense Before Senate Committee Compares 1914 and Present-Day Conditions

The Illinois Senate committee on public utilities on May 7 requested the Public Utilities Commission of that state to make a reply to criticisms passed upon it and to give also any information concerning the administration of the public utilities law generally and with particular reference to emergency rates made during the war. In complying with this request the commission answered all complaints with facts and responded with data on administration of the law. The report also includes some observations on the so-called "home rule" of public utilities. Two tables that are included in the data represented are reprinted in part here.

TABLE I—COMPARISON OF RATES FOR ELECTRIC SERVICE

As of Jan. 1, 1914, 1918 and 1919, in cities of over 1000 population

	Electric Lighting Service	
	Number	Per Cent
Cities in which 1918 rates exceeded 1914 rates	13	5.2
Cities in which 1918 rates were less than 1914 rates	126	50.0
Cities in which 1918 rates were same as 1914 rates	113	44.8
	252	100.0
Cities in which 1919 rates exceeded 1914 rates	115	45.7
Cities in which 1919 rates were less than 1914 rates	102	40.5
Cities in which 1919 rates were same as 1914 rates	35	13.8
	252	100.0
Cities in which 1919 rates exceeded 1918 rates	147	58.1
Cities in which 1919 rates were less than 1918 rates	5	2.0
Cities in which 1919 rates were same as 1918 rates	101	39.9
	253	100.0

Table I shows recent rate movements in Illinois by comparing the rates for electric service for various years—the rates for 1918 with 1914, for 1919 with 1914, and for 1919 with 1918.

TABLE II—RELATION OF EFFECTIVE ELECTRIC RATES WITH FRANCHISE RATES

As of Jan. 1, 1914, 1918 and 1919, in cities of over 1000 population

	Electric Service	
	Number	Per Cent
Cities with rate-restricting ordinances	162	62.0
Cities without rate restrictions in ordinances	87	33.5
Ordinances not available	12	4.5
Total cities considered	261	100.0
Cities in which 1914 rates exceeded ordinance rates	10	6.5
Cities in which 1914 rates were less than ordinance rates	112	72.7
Cities in which 1914 rates were same as ordinance rates	32	20.8
	154	100.0
Cities in which 1918 rates exceeded ordinance rates	4	2.5
Cities in which 1918 rates were less than ordinance rates	120	76.5
Cities in which 1918 rates were same as ordinance rates	33	21.0
	157	100.0
Cities in which 1919 rates exceeded ordinance rates	40	24.8
Cities in which 1919 rates were less than ordinance rates	107	66.5
Cities in which 1919 rates were same as ordinance rates	14	8.7
	161	100.0

Table II gives the relation of rates in effect in the state on various dates to the rates provided for by ordinance.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

Power Supply in Germany.—C. REINDL.—The problem of providing cheap power in spite of the great increase in prices of materials, machinery and labor is discussed, and it is recommended that power machinery should as far as possible be standardized and arranged for high speed and efficiency. Large waterfalls should be assigned to the great chemical industries, which depend entirely upon cheap power, and the smaller ones to electrical transmission lines. A number of small turbine installations can often be built as cheaply as one large one and prove more profitable when continuously feeding a transmission line than would be the case if installed in separate factories, flour mills, etc. Railways should be driven electrically, normally from water power, peak loads being supplied by high-efficiency steam-turbine installations built at the pit. Coal should only be used for heating and the production of gas. The erection of coal-fired power stations for constant service should in future be prohibited, while existing ones should be regarded as stand-by equipment only. Those in conjunction with hydro-power works without storage should, as far as possible, be operated continuously and excess of output taken by hydro-power-stations with water storage facilities. This would effect a saving of 11 per cent of fuel compared with self-contained power stations.—*Technical Supplement to Review of Foreign Press*, April 29, 1919. (Abstracted from *Zeits. für das Gesamte Turbinenwesen*, Feb. 20 and 28, 1919.)

Conservation of Tin in Bearing Metals, Bronzes and Solders.—G. K. BURGESS and R. W. WOODWARD.—Recommendations are made for conserving tin in bearing metals, bronzes and solders by substitution of other alloys with constituents of the alloys. The tables given show the properties of the substituted alloys.—*Technologic Paper No. 109*, Bureau of Standards.

Carbon Brushes Considered in Relation to the Design and Operation of Electrical Machinery.—P. HUNTER-BROWN.—Properties of carbon brushes are discussed and curves are given showing the relation of the contact drop to the current density. A curve shows the coefficient of friction and contact drop at 40 amp. per square inch of a pure graphite brush. The design of brush is also discussed, and methods are shown for making the selection of grades.—*Journal of the (British) Institution of Electrical Engineers*, February, 1919.

A 45,000-Kw. Turbine Generator for Narragansett Electric Light Company, Providence.—This unit is the Westinghouse cross-compound double-unit type, consisting of a high-pressure and a low-pressure turbine, each connected by a flexible coupling to its own generator, having a capacity of 22,500 kw. and mounted on separate plates supported on foundations lying parallel to each other. The unit was designed to operate at a steam pressure at the throttle of 200 lb. (14 kg. per sq.cm.) with 100 deg. (55 deg. C.) superheat and a vacuum of 29 in. (737 mm.) in the exhaust. The generators have a rating of 23,750 kva. at 11,000 volts, three-phase, 60-cycle, at 0.95 power factor, the high-pressure element having a speed of 1800 r.p.m. and the low-pressure element one of 1200 r.p.m.—*Street Railway Bulletin*, March, 1919.

Lamps and Lighting

Transmission of Colored Light Through Fog.—C. L. UTTERBACK.—Measurements were made on thick, medium and slight fogs, but the data given in the paper are for medium fogs only. The fogs studied were produced in air which was filled with dust particles, and it is believed that such a fog is typical of outdoor fogs in the large cities. The data show that the transmission is highest for wave lengths from about 5300 to about 5200 (yellow) and falls off very rapidly toward the red but not so rapidly toward the violet end of the section.—*Transactions I. E. S.*, April 30, 1919.

Some Experiments on the Eye with Different Illuminants.—C. E. FEREE and G. RAND.—In the first part of this paper results are given showing the comparative effect of the following incandescent lamps on the power of the eye to sustain clear and comfortable seeing: The carbon metallized-filament lamp, the tungsten vacuum lamp, the gas-filled lamp and the "daylight" lamp. Welsbach gas mantles of different proportions of ceria and thoria were taken up in the second part, and the results obtained with these were compared with the kerosene flame.—*Transactions I. E. S.*, April 30, 1919.

Generation, Transmission and Distribution

Resistance and Reactance of Three-Phase Armored Cable to Third Harmonics.—SWYNGEDAUM.—When a three-phase star-connected generator is earthed and feeds isolated loads there is a possibility of over-voltages in the system. The third harmonics of the emf. develop synchronous capacity currents in the three conductors of the cable. These currents set up lines of force round the conductors inside the sheathing and outside the cable. In order to predict these surge voltages, it is necessary to know the effective resistance and reactance of the cable. In order to determine the effective resistance and reactance of a cable, a loop was formed with two three-phase cables leading from a substation to a transformer station, and the impedence and effective resistance were determined by the aid of current and pressure measurements. With 3 $\times$ 100-sq.cm. cables having 4-mm. lead sheaths and two armorings 0.8 mm. thick, the effective resistance at 50 cycles was about 0.5 ohm per kilometer; *i.e.*, fourteen times the ohmic resistance to direct current. Measurements at frequencies of 50, 150 and 450 cycles showed the resistance to vary almost linearly with the frequency; *i.e.*, according to the law $r = a + bF$. From 0.5 ohm per kilometer at 50 cycles the effective resist-

ance increases to 0.9 ohm per kilometer at 450 cycles; that is, it is not doubled though the frequency is ninefold. The effective reactance follows a similar law and is about 0.8 r. It is doubtless owing to the powerful damping effect of the metallic sheath of the cable, as regards third harmonics, that so few cases of overvoltage trouble are encountered, notwithstanding the importance and frequency of cases in which the third harmonic is concerned. The values of resistance per kilometer (r) and reactance per kilometer (x) were about 25 per cent higher in the case of cables in the same trench. For the cables tested and for the third harmonic of the fundamental frequency, 50 cycles per second, r varied from 0.67 to 0.78 and x from 0.45 to 0.56 ohm per kilometer.—*Science Abstracts, Section B.* (Abstracted from *Comptes Rendus*, Dec. 16, 1918; *Revue Générale d'Electricité*, Feb. 1, 1919.)

Development of Hydroelectric Installations in Spain.—A large number of applications for concessions for waterfalls varying in capacity from 20 hp. to 3600 hp. have recently been made to the Spanish government. The machinery, etc., required for the smaller installations is to be supplied by Spanish firms, while the higher capacity will probably be obtained from abroad, especially Switzerland. The Chamber of Commerce at Valencia has instituted a public inquiry with a view to the development of the falls of the River Jucar (Albacite) and of the transmission to Valencia of 6400 hp. of electricity. The Sociedad Minera y Metalurgica de Penarroya has installed a number of transport lines for power, one of these, at 70,000 volts, connecting the central station at Penarroya to the hydroelectric plant at Linares, the property of the Compañia Mengamor. Another line, at 30,000 volts, will connect the same central station with Cordoba. Three other secondary lines for the various mine operations of the Penarroya company are now under construction. A Spanish company with a capital of $30,000,000 has been floated for exploiting the falls of the Douro near the Spanish-Portuguese frontier. The power available, estimated at 150,000 hp., will be conveyed to Madrid and Bilboa, and a proposal is on foot to utilize it for electrifying the railways of northern and eastern Spain.—*Technical Supplement Review of Foreign Press*, April 1, 1919. (Abstracted from *Rivista Tecnica d'Elettricita*, Feb. 25, 1919.)

Installations, Systems and Appliances

Large Mercury-Vapor Rectifiers in Hirschberg Electricity Station.—J. OBACH.—The reasons for installing high-power mercury rectifiers in this station are explained, the three-cylinder rectifiers for 750 kw. are described, and the results of the first year's working as regards maintenance, depreciation and efficiency are summarized. It is concluded that, owing to the relatively low first cost, small maintenance and depreciation, and in particular the high efficiency, such ironclad mercury rectifiers have a great future in competition with rotary converters. The three rectifier cylinders are side by side on a common base which accommodates isolating knife switches for the anodes, the supply cables and the cooling outlets. The three rectifiers (750 kw. total) and the vacuum pump occupy about the same floor space as a 100-kw. rotary and weigh only 4100 kg. Details are given of the electrical and water-cooling arrangements. In emergency a water injector supplied from the town mains can be used to accelerate the flow of cooling water. Connections are shown by which the rectifiers are operated in parallel with the rotary converter. Data are given from a year's experience of the rectifiers in service. Such defects as arose were easily corrected and are not likely to recur. The total capital cost of the three 250-kw. rectifiers, including switch gear, accessories and erection, was 56,589 marks. The average over-all efficiency for the year was 90 per cent, including all losses in transformers, induction regulators, auxiliary machines and cables. As regards efficiency, attendance and maintenance, the rectifiers are considered to be much superior to rotary converters and applicable to much larger installations than the present one.—*Science Abstracts, Section B*, Jan. 31, 1919. (Abstracted from *Elektrot. Zeits.*, Oct. 17 and Oct. 24, 1918.)

Ellectricity in Household Service; Motor-Driven Domestic Devices.—T. W. BEHAN.—The writer discusses the general principles of various types of electric washing machines, vacuum cleaners, sewing machines, refrigerating plants, etc.—*General Electric Review*, March, 1919.

Electric Propulsion of Ships.—J. F. NIELSON.—After tracing the transition from the propulsion of ships by reciprocating steam engines to direct-coupled turbine machinery, the author draws attention to the problem presented to marine engineers of how to overcome the antagonism between turbine and propeller efficiencies which led up to the adoption of mechanical, hydraulic and electrical transmission gears. The development of electrical transmission gears is then traced and particulars of recent notable installations of such systems are given in detail. The advantages peculiar to this system are then stated, discussed and compared with the results obtained and guarantees given by the advocates of mechanical gearing. Emphasis is laid upon the greater immunity from total breakdown possessed by the electrical method, owing to the possibility of utilizing a plurality of motor and generator units.—London *Electrician*, April 11, 1919.

Electrophysics and Magnetism

Natural Frequency of a Circuit Containing an Iron-Cored Inductance.—H. G. CORDES.—A mathematical paper in which the natural frequency of an oscillatory circuit containing an iron-cored inductance is treated. An expression in which the effect of eddy currents in the iron has been taken into account is found for the natural frequency of the circuit.—*Science Abstracts, Section B.* (Abstracted from *Proceedings Inst. Radio Eng.*, February, 1919.)

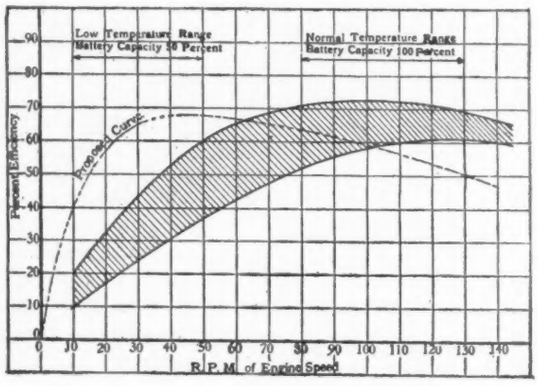
Electrochemistry and Batteries

Electrical Characteristics and Testing of Dry Cells.—This circular summarizes the available information on dry cells. A brief description of materials of construction and elementary theory of the operation of the cells is given. The various kinds and sizes of dry cells are mentioned and electrical characteristics of the cells and methods of testing them are discussed.—*Circular No. 79*, Bureau of Standards.

Electric Smelting of Domestic Manganese Ores.—H. W. GILLETT and C. E. WILLIAMS.—The conclusion to be drawn from this investigation is that although the electric smelting of manganiferous slags and low-grade domestic ores is unlikely to be profitable at times of

normal costs and prices, such smelting is metallurgically possible and could be done profitably in times of high prices.—*War Minerals Investigations, Series No. 10,* Department of the Interior.

Characteristics of Starting and Lighting Batteries of the Lead-Acid Type.—O. W. OETTING.—The author analyzes the problem of the design of starting and lighting batteries for automobiles to give better performance during the winter months. He points out the fact that the lead storage battery has about 50 per cent of its normal capacity at a temperature of 10 deg. Fahr. and also that the voltage characteristics drop off more rapidly with discharging currents of low temperature than at normal temperature. The suggestion was made to change the characteristics of the efficiency curve of the starting motor so as to increase the total efficiency



HIGHEST EFFICIENCY OF STARTING MOTOR SHOULD OCCUR AT LOW CRANKING SPEEDS

of the starting system for cold-weather conditions. The proposed change is shown in the accompanying curve sheet, indicating that the highest efficiency of the motor should be obtained at lower speed, such as might be experienced in cold weather.—*Electric Journal,* April, 1919.

Telegraphy, Telephony and Signals

The Vertical Grounded Antenna as a Generalized Bessel's Antenna.—A. PRESS.—By taking account of the variable distribution of inductance and capacity along a vertical grounded antenna the general expression for the current at any point of the antenna is obtained. Fo. the case of an antenna having zero current at the top and maximum current at the (unloaded) bottom, the particular solution for current and voltage distribution is obtained.—*Science Abstracts, Section B,* March, 1919. (Abstracted from *Proceedings Inst. Radio Eng.,* December, 1918.)

Electromagnetic Theory of the Telephone Receiver.—By A. E. KENNELLY and H. NUKIYAMA.—In the theory of the motional-impendance circle certain phenomena have been left out of consideration for the sake of simplicity, and especially that component of alternating magnetic flux passing through the coils which is due to the displacement of the diaphragm from its zero position when freely vibrating. The result has been that the motional-impedance circle failed to reveal the power expended parasitically in the magnetic circuit. It was the object of this paper to supply the above-named omission and thus offer a closer approximation between the theory and the observed behavior of the telephone receiver as an electromagnetic motor. The limitations of the new theory are discussed and the magnet circuit and vibrating system are outlined, together with simplified magnetic and mechanical circuits of the bipolar receiver. Other discussions are given on the magnetomotive force damped and free, magnetic flux damped and free, electromotive force damp and free, impedances damped and free and motional electric power damped and free, mechanical velocity damped and free, mechanical displacement, force diagram damped and free, motional electromotive-force diagram, motional impedance and motional power. The effect of the apparent increment in the mechanical resistance is to introduce a slight distortion of the motional-impedance power diagrams from a strictly circular locus, assuming the force factor and other constants to remain substantially the same at all frequencies, but the distortion is not serious from a practical standpoint.—*Proceedings A. I. E. E.,* April, 1919.

Units, Measurements and Instruments

Analysis of Alternating Currents with the Vibration Galvanometer.—A. BLONDEL.—Two cases are compared, (1) in which the galvanometer circuit is non-conductive, (2) in which it contains one or more condensers. In the first case the sensitiveness at resonance varies inversely as the resistance of the circuit, the total (mechanical plus electromagnetic) damping and the frequency. In the second case the sensitiveness is proportional to the capacity and varies inversely as the mechanical damping, but is independent of the frequency. The sensitiveness of the galvanometer to frequencies other than that for which it is tuned is investigated. The suppression of harmonics lower than that being measured is best effected by the condenser circuit. The reverse is the case for higher harmonics. As an illustration results are given from measurements on the wave form of the Paris supply, showing the separation of the thirteenth harmonic. In the practice of the method it is necessary to remember that the mechanical damping varies with the length of the vibrating system and to calibrate the galvanometer for each length it is desired to use. A combination of mechanical with electrical resonance affords more perfect suppression of other harmonics but involves considerably more complication.—*Science Abstracts, Section B,* March, 1919. (Abstracted from *Comptes Rendus,* Nov. 11, 1918.)

Miscellaneous

College of Engineering and Engineering Experiment Station of the University of Illinois.—The value of engineering education in military work is indicated in tables. Charts are also given which show that about 75 per cent of graduates of engineering are directly or indirectly engaged in engineering work. The work of the engineering experiment station is outlined and a list of publications is given.—Published by the University of Illinois, Urbana, Ill.

Publications of the Bureau of Standards.—Summaries of scientific papers, technologic papers, circulars and miscellaneous publications are listed in this bulletin.—*Circular No. 24,* Bureau of Standards.

Industrial Education Survey of the City of New York.—This is the second booklet on inside electrical work and tells about the qualifications and training of electricians together with average wages of union men. It points out the opportunities for young men to enter into the electrical field as electricians and details the sort of work which they are required to do.

Readers' Views and Comments

Elimination of the Purple Color in Lamp Globes

To the Editor of ELECTRICAL WORLD:

SIR: It is a fact of common observation that lighting glassware exposed to radiation rich in ultra-violet rays such as are emitted by arc lamps and the sun often assumes a purplish tinge. This color, which is due to manganese, becomes more and more conspicuous as the time of exposure increases. X-rays also develop this purplish tinge in glasses containing manganese. In an article[1] published in 1917 the writer mentioned among other things a discovery which he had made, namely, that the purple color could be made to disappear by the application of heat at a temperature below that at which the glass lost its rigidity. Recently Alfred Herz[2] published an article in which he described in detail the heat treatment of arc-lamp globes on a commercial scale and showed that the removal of the purple discoloration was practicable in the case of glass containing manganese.

However, the chief aim of the former article has itself been overlooked, and it appears worth while to renew the proposal made. Many samples of street-lighting glassware were studied, and it was found that such glassware still remained in use when the purple color which gradually developed had become very highly absorbing. Many samples showed that the transmission factor had been reduced from about 90 per cent for clear glass to as low as 60 per cent. Glassware which went out of service merely through accidental breakage showed transmission factors as low as 50 per cent of clear glass. Purple is a surprising color in this respect; that is, its absorption is extremely high per unit of "colorfulness." In other words, the manganese purple is really a gray purple, and it can be very highly absorbing before its color is likely to be noticed by the casual observer.

As is well known, manganese is used in glass to counteract the greenish tinge of iron compounds which exist in most sands. This use is purely for esthetic purposes and is camouflage in its purest sense. For household glassware, decorative lighting glassware, etc., this greenish tinge is objectionable, but it is not so objectionable in street-lighting glassware as to warrant the introduction of manganese, which is an evil in every sense. The initial introduction of manganese causes a decrease in transmission factor of a few per cent, and as already noted the gradual development of this purplish tinge by ultra-violet radiation makes manganese in lighting glassware an ever-increasing evil. But manganese has been used so extensively in glassmaking that it has become to many an essential ingredient.

The point emphasized in the earlier paper was the elimination of manganese from glassware exposed to sunlight or to other illuminants rich in ultra-violet rays. There should be no objection to a slight greenish tinge in lighting glassware to be used outdoors. It was suggested in that article and is emphasized here that specifications for street-lighting glassware demand the elimination of manganese.

M. LUCKIESH.

Nela Research Laboratory, Cleveland, Ohio.

[1] "Purple Color of Lamp Globes," *General Electric Review*, August, 1917.
[2] ELECTRICAL WORLD, Nov. 16, 1918.

Electric Heating and the Impropriety of Its Use in War Time

To the Editor of ELECTRICAL WORLD:

SIR: The writer desires to register a protest against the spreading of such "Hunnish" propaganda as that contained in a Canadian publication dated Feb. 1, 1919, bearing the heading "Heating Our Homes with Electricity —A Pioneer Installation in Toronto Which Proves that Electric Heating Is Entirely Practical—Cost Not Prohibitive for the Well-to-do Citizen."

In the first place, may I point out that while the installation in question may be the "pioneer in Toronto," it is an exact duplicate, apart from automatic control, of one which was operated in McCormick's drug store on Sparks Street in Ottawa, Ontario, "just twenty years ago." The latter installation was very successful in so far as maintaining agreeable temperatures was concerned, but it was of course abandoned as soon as the misguided enthusiast who bore the cost of the work woke up to an appreciation of the facts surrounding the problem of electric heating.

In Italy during the war it is said to have been an indictable offence to use any electric heating device between the hours of 4 p. m. and 10 p. m. daily or to sell any electrical heating device whatever. May I ask if conditions were so very different in Toronto that "domestic electric heating" in the winter of 1917-18 was so "entirely practical" as to deserve special commendation? Many of your readers surely heard of the efforts made to prevent the wasting of electrical energy in and around Toronto on account of the power shortage in that vicinity. Darkened streets and windows were intended to remind thoughtless ones we were at war!

An illustration used with the article referred to showed electrical energy continuously used for heating, a record of one of the most flagrant cases of wanton waste in war-time which have come to my attention. I am tempted to speak with vigor upon the above subject because I am one of the multitude who sacrificed time and energy, as well as such money as I had at my command, to help the cause of humanity. My very hardest work and most trying experiences were connected with the effort to get kilowatt-hours released from non-essential undertakings so that they would be continuously available for badly needed war work; and my efforts were made in the very district where this electric heating crime was being perpetrated! Were there many other such installations in Toronto as the one so highly praised? Are there many other extravagant persons in that vicinity who spent $480.18 for the luxury of electric heat when coal costing only $144 would have done the same heating?

The case in question would not have been so bad if the electrical energy used in that heating installation came from absolutely independent hydroelectric plants; but, as is common knowledge, old steam plants were pushed to the limit at that time, and the United States authorities none too willingly allowed coal to come into Ontario for producing power, in order that the outputs of overloaded Niagara hydroelectric plants might be supplemented by steam power and in this manner render further aid to the production of munitions. Just think of the criminally farcical nature of this state of affairs! A Torontonian drawing electrical energy which he uses for heating out of a system during periods when from five to ten times as much coal had to be burned (to put that same amount of electrical energy back into the system) as would have heated his house! All this at a time when coal was costly and scarce and when electrical energy was never so badly needed in this world for every legitimate purpose.

At the meeting of the Engineering Institute of Canada in Toronto, in March, 1918, electric heating was clearly and unanimously shown to be practically impossible. At that meeting, with the needs of the Allies in plain view and with the horrible Niagara power shortage before us, I protested not only against using electrical energy for heating but also against the putting into force throughout Ontario, a short time before the meeting, of a secondary or tertiary rate for the use of electrical energy which tended to encourage the putting on of wasteful heating loads. If my memory serves me, I asked the meeting if such tactics—which would surely interfere with war work—were for the purpose of "making the Kaiser grin"?

That is exactly what I mean to imply now in the opening paragraph of my letter when I refer to "Hunnish propaganda." The Hun did not want us to help to win the war; he did everything in his power to block us, and even now he does not want us to conserve or to make proper use of our resources.

JOHN MURPHY.

Ottawa, Canada.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

BOSTON EDISON RATE HEARINGS CONTINUED

Main Case Will Proceed, According to Present Plans, on June 30 — Company Completes Replies to Interrogatories of Petitioners

At a continued hearing on Monday of this week, on the petition of various customers of the Edison Electric Illuminating Company of Boston for reduced rates, it was decided to continue the hearings to June 30, when the main case will go forward. The company has now practically completed all its responses to the interrogatories of the petitioners. The latter endeavored Monday to force the company to file complete lists of customers in the public record in the case. The company objected to this, in view of the inimical use threatened by the petitioners, and was sustained by the commission. It was agreed that the petitioners may have the privilege of scrutinizing representative lists of customers.

A. I. E. E. WILL CONVENE AT LAKE PLACID, N. Y.

Modification of Institute's Activities to Receive Thorough Consideration — Papers in Technical Program Announced

The American Institute of Electrical Engineers holds its thirty-fifth annual convention at the Lake Placid Club, Lake Placid, New York, from June 24 to 27. In order to leave ample time for consideration and discussion of the Institute policies at conferences under the auspices of the committee on development, the technical program has been somewhat curtailed. So many modifications in the activities of the Institute are being suggested that it has been thought advisable for the entire membership to review and study them.

The annual presidential address by President Comfort A. Adams will open the convention on Tuesday morning and will be followed by the introduction of President-elect Calvert Townley. Three papers, presented under the auspices of the protective devices committee, will complete this session. They are entitled: "Present Day Practice of Transmission and Tie-Line Relay Protection," by H. R. Woodrow, D. W. Roper, O. C. Traver and P. MacGahan; "Grounding the Neutral of Generating and Transmission Systems," by H. R. Woodrow, and "Grounded Neutrals," by William E. Richards.

At Wednesday morning's sesson the annual reports of the technical committees will be presented and discussed. They cover the activities of the various committees for the past year and the advances made in the fields of these committees. At a luncheon following this session there will be a conference of the committee on development, section delegates and Institute officers.

Thursday morning's session is to consist of an open conference held by the committee on development, including the section delegates and Institute officers, to which all the Institute members are invited.

The transmission and distribution committee is to hold a technical session on Friday morning, when these four papers are to be given: "High-Tension Single-Conductor Cables for Polyphase Systems," by W. F. Clark and G. B. Shankin; "Electrostatic Field in Electric Power Cables," by R. W. Atkinson; "Commercial Problems of 220-Kv. Power Transmission," by A. E. Silver, and "The Effect of Transient Voltage on Dielectrics—II," by F. W. Peek, Jr.

An informal reception and dance will occupy Tuesday evening, and the convention committee is arranging an unusually complete program of games, contests and other entertainments to fill all the available spare time.

GENERAL ELECTRIC ACQUIRES THE COOPER HEWITT COMPANY

Control Bought by Acquisition of All the Common Stock—Directors to Represent New Ownership—W. A. D. Evans President

The General Electric Company has secured control of the Cooper Hewitt Electric Company by acquiring all the common stock. For the past sixteen years the Cooper Hewitt Electric Company has built up an extensive business in industrial and photographic lighting among large industrial manufacturers, motion-picture studios, photographers and photographic laboratories. The company will be operated under the regulation and management of the General Electric Company, and the following directors assumed office on June 3: C. E. Patterson, comptroller General Electric Company, New York City; C. W. Stone of the General Electric Company, Schenectady; N. R. Birge of the General Electric Company, Schenectady; G. C. Osborne of the Edison Lamp Works of the General Electric Company, Harrison, N. J.; W. R. Burrows of the Edison Lamp Works of the General Electric Company, Harrison, N. J.; L. P. Sawyer of the National Lamp Works of the General Electric Company, Cleveland, Ohio; W. H. Roberts of the National Lamp Works of the General Electric Company, Cleveland, Ohio; Grosvenor Calkins, attorney, Boston, and W. A. D. Evans of the Cooper Hewitt Electric Company, Hoboken, N. J.

W. A. D. Evans, who has been connected with the Cooper Hewitt Electric Company since its inception, will be in actual charge of the company as president and treasurer. N. R. Birge is vice-president, C. P. Hamilton assistant treasurer and E. E. Davies secretary and auditor.

The present policy of the company in its field of industrial and photographic lighting will be continued. Increased facilities will be provided shortly to take care of the rapidly increasing business.

Vice-Presidents of the N. E. L. A. Will Have Active Part in Association Work Under the Organization of President-Elect Ballard

MARTIN J. INSULL
First Vice-President
Mr. Insull is senior vice-president of the Middle West Utilities Company, Chicago, Ill.

MILAN R. BUMP
Second Vice-President
Mr. Bump is chief engineer of the Henry L. Doherty Operating Organization.

FRANK W. SMITH
Third Vice-President
Mr. Smith is vice-president and general manager of the United Electric Light & Power Company, New York.

WALTER H. JOHNSON
Fourth Vice-President
Mr. Johnson is vice-president of the Philadelphia Electric Company, Philadelphia.

PLAN OF ORGANIZATION OF N. E. L. A. FOR THE COMING YEAR

President-Elect Ballard, Remaining in East After Atlantic City Convention, Arranges for Active Participation of the Vice-Presidents

President-elect R. H. Ballard of the National Electric Light Association came to New York at the close of the Atlantic City convention to discuss matters affecting the activities of the association during the coming year. A number of conferences were held at association headquarters with different men interested in the welfare of the industry, and much progress was made in the settlement of various questions.

One of the most important matters which were finally arranged is a new plan for the active participation of the four vice-presidents in the real work of the association. Such a plan is especially desirable under the conditions of this year because of Mr. Ballard's residence on the Pacific Coast. It, however, serves also the good object of decentralizing the burden of responsibility upon the president and of bringing the vice-presidents into close contact with certain phases of the association work.

The plan approved by President-elect Ballard is as follows:

President Ballard will devote himself specially to matters of a general executive character.

Martin J. Insull, the first vice-president, will be executive vice-president. He will be present to preside over all meetings of the executive committee in case of the necessary absence of the president.

M. R. Bump, second vice-president, will supervise the work of the Technical and Hydroelectric Section. Mr. Bump will also specialize on the preparation of plans for organizing the entire country into geographic districts and sections.

Frank W. Smith, the third vice-president, will supervise the Accounting Section in the same way that is outlined for Mr. Bump with the Technical and Hydroelectric Section. Mr. Smith will also supervise the work at association headquarters.

W. H. Johnson, the fourth vice-president, will supervise the activities of the Commercial Section and the Electric Vehicle Section, following the same method as the other vice-presidents with respect to other sections. Mr. Johnson will also specialize on the enlargement and development of company sections.

The arrangement, by which the work of the sections is assigned to the various vice-presidents, does not, of course, preclude a chairman of a section from taking up any matter directly with the president if he so desires.

Another matter which was under discussion during the visit of Mr. Ballard in New York is the possibility of two or more general executive conferences of the company members at appropriate times during the year. The object will be to discuss some of the questions affecting the entire industry. It is suggested that possibly one of these conferences might be in New York and one in Chicago.

Mr. Ballard spent two weeks in the East after the convention, visiting several large cities before going to Los Angeles. He plans to return to New York in September for a stay of considerable length. He will return again in December or January. In order to complete plans for the 1920 convention he will come East again in April of that year. With these visits and the new plan of organization of the vice-presidents, supplemented by correspondence, Mr. Ballard expects the association work to go ahead on the broader and more active lines which are outlined for the coming year.

Hydroelectric Energy for Operating Oil Wells

Since 1908 the San Joaquin Light & Power Corporation has been actively engaged in the introduction of electric power in the drilling and pumping of oil wells. What has been done by the company shows in an interesting way just how hydroelectric power can compete with other fuels. At the present time the San Joaquin Light & Power Corporation is operating 2255 oil wells by hydroelectric power, where natural gas and oil at field prices are available. A. E. Wishon, assistant general manager of the San Joaquin Light & Power Corporation, is largely responsible for the marked success of the company in this field.

ENGLAND'S PLANS FOR SUPPLYING ELECTRICITY

Government Bill Reaches Second Reading in the House of Commons—Some of the Provisions for Unifying Sources of Supply

Companies in this country will be interested in the general trend of legislation to foster central-station development in England, which is far behind the United States in providing electric power facilities.

The electricity supply bill of England, the government measure, has been introduced in the House of Commons and had its second reading on May 14. Some of its principal provisions are summarized in an abstract which has been made from London contemporaries and appears below:

For "promoting, regulating and supervising the supply of electricity" there shall be established the "Electricity Commissioners," who shall have such powers as are conferred by the act and shall act under directions of the Board of Trade. The commissioners, not exceeding five in number, shall be appointed by the Board of Trade, which shall fix the term of two, the others holding office during His Majesty's pleasure.

The Board of Trade may exercise through the Electricity Commissioners any powers or duties under the electric lighting acts or orders made thereunder.

The Electricity Commissioners may, subject to approval of the Board of Trade, either by themselves or through any district electricity board established under the act, or any authorized undertakers, conduct experiments or trials for improvement of the methods of supply and incur necessary expenditure therefor.

The commissioners may appoint a committee from members of district electricity boards or other specially qualified persons for advice and improvement and development of supply.

The commissioners may, after holding local inquiries, create districts with boards, having as members representatives of local authorities, companies and persons who are authorized undertakers within the district, of large consumers of electricity within the district and of labor, and where any councils, not being authorized undertakers, agree to afford financial assistance to the board, also of representatives of those councils. The commissioners may appoint as chairman of the district board a person experienced in the control of large industrial undertakings. Areas included in the districts shall be grouped in such manner as may seem to the commissioners most conducive to efficiency and economy of electricity supply.

"A CHEAP AND ABUNDANT SUPPLY"

It shall be the duty of every district board to provide or secure the provision of a cheap and abundant supply of electricity. Such board shall have such powers and duties with respect to the acquisition of generating stations, acquisition or use of main transmission lines of authorized undertakers, supply of electricity (including construction of generating stations, main transmission lines, etc.) and acquisition of undertakings or parts of undertakings of authorized distributers and power companies.

All generating stations within a district, other than private stations, and such main transmission lines as may be specified in the order constituting a district board, shall vest in the board subject to payment of the standard price but freed and discharged from all mortgages and other charges, and the proviso to Section 78 of the schedule to the electric lighting (clauses) act shall apply as if the generating stations and main transmission lines had been sold under Section 2 of the electric lighting act, 1888; in any case where it is proved to the satisfaction of the commissioners that any particular generating station is so small or so situated or equipped that it could not conveniently be used the commissioners may, after giving the owner an opportunity of being heard, exempt the district board, for such period as may be specified, from the obligation of acquiring the station. For the purposes of this section the standard price shall be: (a) generating station or main transmission line belonging to a local authority, one or more annuities for such period as an auditor appointed by the commissioners certifies to be required to indemnify the local authority against its liabilities for interest and sinking fund charges in respect of such sums borrowed to provide the generating station or main transmission line as are outstanding at the date of transfer, provided that if it is proved to the commissioners that a substantial part of the cost otherwise than for renewals has been defrayed from revenue, such annuity may be increased as the commissioners think just; (b) generating station or main transmission line belonging to a company or person, such sum as may be certified by an auditor appointed by the commissioners to be the cost of and incidental to the construction of the generating station or main transmission line and acquisition of the site thereof less depreciation; such cost and depreciation shall be determined according to regulations of the commissioners; in any exceptional case if it is shown to the satisfaction of the Board of Trade that the amounts determined would work injustice they shall, in default of agreement, be determined by an arbitrator. The commissioners may by order transfer an easement, right or benefit under a contract to the district board for such consideration as, failing agreement, may be determined by an arbitrator. A district board may, with consent of the commissioners, by agreement with the owners acquire any private generating station on such terms as may be agreed. When a district board acquires a station otherwise than by agreement there shall be an obligation thenceforth to supply to the authority, company or person not less electricity than could have been generated at that station at a price not greater than that at which it could have been generated. Where a station or main transmission line has been acquired by a district board the board may, subject to approval of the commissioners, agree that the former owner shall work and maintain it on behalf of the board.

Where a district board is authorized to acquire or use any land for a generating station no person may restrain such use.

NEW STATIONS

It shall not be lawful for any authority, company or person except a district board to establish a new or extend an existing generating station without consent of the commissioners, but this restriction shall not apply to private generating stations, provided that where a group of persons carrying on or intending to carry on businesses in which large quantities of electricity are used for purposes other than provision of mechanical power or light propose to establish a generating station for such businesses the commissioners may authorize establishment by or on behalf of those consumers of a generating station, subject to condition that any surplus electricity generated shall be supplied to the district board or any authorized undertakers or any authority, company or person at such prices as the commissioners think fit.

A district board may by agreement with authorized undertakers or authority, company or person or without such agreement if authorized by the commissioners use any main transmission line of undertakers, authority, company or person for such time and on such terms as may be agreed or in default of agreement determined by the commissioners.

A district board shall not have power to supply electricity within the district (a) in any area which for the time forms part of the area of supply of authorized distributers without the consent of those distributers, except to lighting authorities or to railway, tramway, canal or inland navigation companies or authorities for traction or haulage or for lighting vehicles and vessels for the haulage or traction of which electricity is supplied; (b) in any part of the area of supply of a power company for any purpose for which the company is authorized to supply electricity without the consent of the company provided that where the authorized distributers or power company re-

fused consent the district board may appeal to the commissioners, and the Board of Trade on recommendation of the commissioners may dispense with such consent if in their opinion it is unreasonably refused. This act shall in relation to every district board be deemed a special act for purposes of the electric lighting acts, and every district board shall be deemed undertakers within the meaning of those acts, and for purposes of this section there shall be incorporated with this act the provisions of the schedule to the electric lighting clauses act, 1899, subject to such modifications as may be prescribed by the Board of Trade, provided that Sections 2 and 3 of the electric lighting act, 1888 (which relate to the purchase of undertakings by local authorities), shall not apply to undertakings of district boards. Subject to the limitations on the powers of a district board to supply electricity, the commissioners may after such inquiry as they think fit impose on any district board an obligation to supply electricity in such circumstances, within such areas and on such terms and conditions as may be specified.

TERMS OF TRANSFER

Any local authority authorized as distributer may with consent of the commissioners agree with the district board for transfer to the board of the whole or any part of the undertaking in consideration for the payment of annuities for such periods as an auditor appointed by the commissioners may certify to be required to indemnify the local authority against its liabilities for interest and sinking fund charges in respect of so much of the money borrowed for the undertaking as is outstanding at the date of transfer. Provided that where any generating station or main transmission line belonging to the local authority has previously been acquired by the district board under this act the interest and sinking fund charges in respect of money borrowed for providing the generating station or main transmission line shall not be taken into account. Where under the electric lighting acts or under any order thereunder or under any special or local act any right to purchase the whole or a part of the undertaking of any authorized undertakers is vested in any local authority (including a county council) the right shall be transferred to the district board and the board shall exercise such right except in any case where the commissioners consent to postponement; provided that (a) if the area of the local authority is divided between the districts of two boards the right shall be transferred to such board or divided between them as the commissioners determine, and (b) where the undertakers are a local authority the power transferred to the district board shall not be exercised except with consent of the commissioners. Where any such right becomes exercisible before the date of the transfer of the right to a district board the right shall not be exercised by the local authority without consent of the commissioners. A district board with the consent of the commissioners may at any time acquire the whole or a part of the undertaking of any authorized undertakers not being a local authority by agreement.

The commissioners may on application of a district board exclude from the area of supply of any power company any part of that area which at the time of application is not being supplied by the company and which it appears to the commissioners could be better served by the district board, and in consideration therefor may if they think fit confer on the company power to supply electricity for lighting purposes in other parts of the area of supply which do not at the time form part of the area of any authorized distributers.

The commissioners shall have power on application of a district board to require authorized undertakers to give such reasonable facilities for the supply of electricity as may be specified, including the provision of new works, and if any other authorized undertakers are unable or are unwilling to comply with such order, the Board of Trade on representation of the commissioners shall have power either (a) to order that the undertaking of the authorized undertakers shall be transferred to the district board on the terms prescribed by Section 2 of the electric lighting act, 1888, or (b) to confer on the district board power to supply electricity within the area of such undertakers or any part thereof.

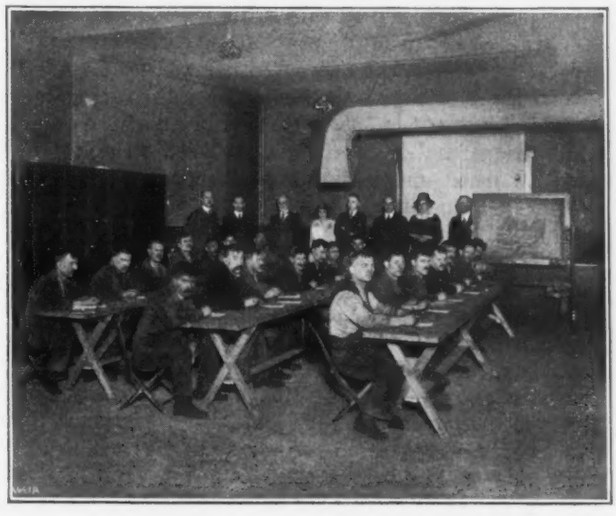
The Board of Trade, on representation of the commissioners, may authorize any district board to abstract water from any river, stream, canal, inland navigation or other source subject to conditions to be specified. A district board and any company or person may, with consent of the commissioners, enter into arrangements for the utilization for purposes of the board of water power, waste heat, or other form of energy which the company or person may be able to dispose of or for supply by the board of any form of energy other than electricity. A district board may with the consent of the commissioners dispose of any generating station, land or other work or property which appears to be no longer required.

The powers and duty as to generation and supply conferred by this act on district boards may be exercised by such boards by themselves or if so authorized by the commissioners through authorized undertakers or a company. For the purposes aforesaid a district board may lease its undertaking to any such undertakers or company upon such terms as, subject to approval of the commissioners, it thinks fit.

If within five years from date of vesting any generating station or main transmission line in a district board under this act any officer or servant who has been regularly employed in or about such station or line proves to the satisfaction of a referee appointed by the Minister of Labor that he suffered loss of employment or diminution of salary or wages otherwise than on grounds of misconduct, incapacity or superannuation and the district board does not show to the satisfaction of the referee that equivalent employment on like conditions as those obtaining before the said date was available the district board shall pay him such compensation as the Minister of Labor shall think just, including expenses which the officer or servant necessarily incurs in removing to another locality.

[Other provisions will be summarized in a later issue.—EDS.]

Americanization Classes at Chicago



Two classes like this at the Fisk Street station and one class at the Northwest station of the Commonwealth Edison Company, Chicago, are regularly conducted as a part of the company's Americanization work. These men are being taught English. Many who at the beginning were unable to talk, read or write English are able, after ten or fifteen lessons, to write simple sentences and to read passages from newspapers and begin to speak the language. Considering that the average age of the men is forty-five years, this is thought to be quite remarkable. The Americanization committee of the Commonwealth Edison Company is headed by D. W. Roper, whose office is superintendent of the street department.

War Service of Commonwealth Edison Company*

How the Company Met the Requirements of War Time and Solved the Physical and Financial Problems

BY LOUIS A. FERGUSON

From Mr. Ferguson's Review of War Accomplishments

Holding the average rate at the old level was a war service of the first importance.

While economies in generation were probably the greatest war contribution, another great saving was by the rerouting of cables.

Careful investigation proved that enough light will increase output in almost any manufacturing establishment from 10 to 30 per cent at a cost of from 2 to 5 per cent of the payroll.

THE largest centralization of electrical generating equipment in Chicago is in the Fisk Street and Quarry Street stations, with a combined present rating of 249,000 kw. During the year 1917 these two stations generated more than 1,000,000,000 kw.-hr. The output for 1918 was somewhat less, owing to the greater activity of the Northwest station. The greatest single day's output of these two stations was on Dec. 20, 1916, the output for that day being 3,720,000 kw.-hr.

The third of the three major generating stations of the present system of the Commonwealth Edison Company is Northwest station, and to us in Chicago this is, for the moment, the last word in central-station construction. During 1918 this station generated 540,000,000 kw.-hr., about 36 per cent of our entire output. The largest generators of the system, rated at 35,000 kw., are in the Northwest station. The total rating of the station at present is 165,000 kw. For all of the generating stations coal is carefully purchased on a test basis and is burned under the constant supervision of competent fuel engineers.

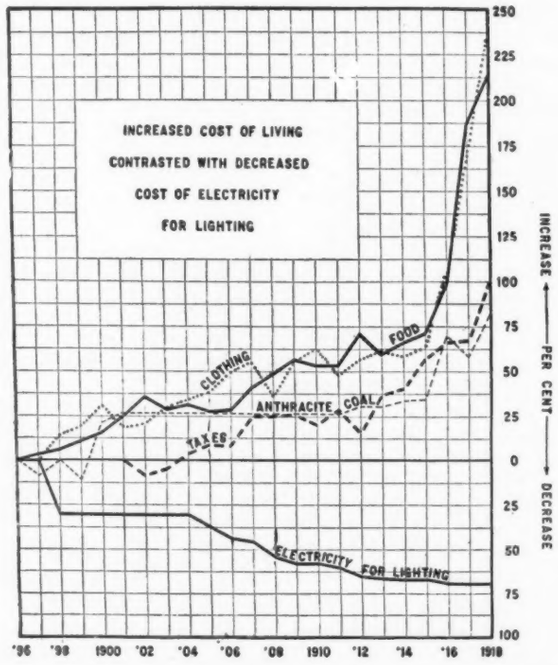
THE COMPANY'S AMPLE RESERVE

It has been the policy of the company to provide ample reserve in all elements of material equipment and to insist habitually on the highest grade of construction. Similarly, the financing of our enterprise has been characterized by the provision of exceptionally liberal reserves and by conservative stability. Samuel Insull has secured a reputation for our securities which places them among the best in the country. But material equipment and financing are only two of the three fundamentals in our enterprise. The third, perhaps the most important of all, is our personnel—the men and women who compose the Commonwealth Edison organization.

This organization gave 1376 men to the service of our country during the war. This is perhaps 30 per cent of our normal force. Of these men 473 have come back to us, and in addition we have already employed 238 soliders who were not in our organization before the war. But while the highest honor must be given to the men represented on the service flag, they were not the only ones who served. The other 70 per cent who stayed at home and operated the company also helped in no small way toward the winning of the war.

A diagram is presented to show the cost of living, in various items, compared with the cost of electricity in Chicago. It will be seen that while the prices of clothing, food, coal and taxes have shot up almost "out of sight," our product, which is no less essential to every citizen, has shown no increase whatever in price. Indeed, considering our retail lighting rates over the period of the last five years, there has been an actual decrease in the average price, and this in the face of an enormous increase in the cost of fuel and of all other materials which go into the making of our product. We feel that the holding of this price at the old level, giving a supply of power instantly as demanded, with a maximum of reliability, has been a war service of the first importance. This has been accomplished, too, in spite of the fact that in four of the principal departments of the Commonwealth Edison Company which report to me the salaries and wages of the men have been increased 52 per cent during the period of the war.

One reason why it was possible for the company to make this showing during the war was that our foresight in providing ample generating units of most efficient type led to a direct saving of at least $1,390,000 in 1918 alone. That is, had all our machines been of the older type (say of 1909 or 1910 design)—and an excellent type, too—the generating cost for the year 1918 would have been $1,390,000 more than it actually was. This amount makes up for a great deal of the increase in the cost of labor and material.



*This is condensed from a recent address by Mr. Ferguson, vice-president of the company, before a meeting of employees under the auspices of the underground-extension and new-business groups of the Commonwealth Edison Company Section of the National Electric Life Association.

This economy of the latest and largest generating units is important. In the Northwest station, for instance, we have vertical 20,000-kw. units and horizontal 35,000-kw. units. The latter are the newer, and their output is generated at a saving of $19,000 per month in operating labor over what would be required with machines of the older type. This is in addition to the saving in fuel. In the larger units the water-rate curve is nearly flat. The steam consumption of a new unit at Northwest station is on the average 10.5 lb. (4.8 kg.), which is also the rate of the larger units at Fisk Street station. Taking into consideration the large type of boilers now being installed, this is equivalent to 2 lb. (0.9 kg.) of coal per kilowatt-hour for a newer unit compared with 3.13 lb. (1.35 kg.) per kilowatt-hour for the older (1910) units at Quarry Street.

COMPARISON OF ALL CENTRAL STATIONS IN UNITED STATES WITH COMMONWEALTH EDISON COMPANY FOR 1917

	Total United States	Commonwealth Edison Company	Ratio of Edison Company to Total, Per Cent
Output in thousands of kw.-hr.	25,438,611	1,488,080	6.1
Income	$502,100,346	$25,351,585	5.0
Income per kw.-hr. generated, cents	1.97	1.75	—
Capacity in kw.	9,001,872	465,980	5.2
Ratio of average kw. output to capacity, per cent	32.3	36.4	—
Average size of generating unit, in kw.	839	8650	—

COAL-MINE OWNERSHIP HELPS

Another source of economy has been in the company ownership of its coal mines. This saving has been an important one, especially during the year 1918, when the price of coal was so high. During that year about 50 per cent of our coal was obtained from our own mines, and the average cost to us of all the fuel we burned was $3.15 a ton. The average market price during the year of such coal as we use was $3.60, so that we saved 45 cents a ton on all our coal. As we burned 1,963,000 tons during the year, the saving amounted to $883,000, to which should be added about $265,000 for profits from coal sold, making a total saving of $1,150,000.

While these economies in generating electricity were probably the greatest war contributions of our Chicago central-station organization, another great saving was by the rerouting of cables. By pulling out some of the older lines in districts where the demand has increased at a rather slow rate and installing them to supply the special war demands, we were enabled to employ copper which we had purchased at 15 cents a pound rather than enter the market for 30-cent copper. Here, of course, there was not only a saving in the price of the copper, but also conservation of the material, as copper was in special demand in the manufacture of munitions and ordnance. I think the major credit for this rerouting scheme is due to G. M. Armbrust. This rerouting plan was also applied to transfer load from less efficient Fisk and Quarry Street units to more efficient generating units at the Northwest station. In this cable rerouting we took advantage of our policy of an ample reserve supply of cable and also of our development of first-class men capable of meeting war conditions. The country got the benefit of this work.

Before the war any customer could secure renewal lamps delivered at his door within about twenty-four hours of his request. But with 30 per cent of our men in government service and with a great increase in the cost of operation and maintenance of vehicles it was necessary to ask our customers to do their own transporting for the time being. Therefore, in February, 1918, we took off all the lamp delivery wagons and established fifteen additional lamp renewal stations, bringing the total number of such stations to twenty-seven.

On the same principle we established a charge of 35 cents to cover a part of the cost of calling at customers' premises to replace fuses, make minor repairs or deliver lamps in those cases where the customer insisted that we bring them to him. Here again the change was accepted with good grace by practically all our patrons. These modifications of our policy were of much greater benefit under the war conditions than could be measured by the comparatively small amount of money collected. Many people are rather thoughtless in handling lamps and demanding renewals when new lamps may be obtained by mere telephone calls, but they become much more careful when it is necessary to make a trip to a renewal station. As a result we saved about 600,000 lamp renewals last year, and the number of service calls was reduced in about the same proportion.

FINANCING LINE EXTENSIONS AND OTHER FINANCING

We made a marked saving by a temporary ruling of the State Public Utilities Commission which permitted us to ask our customers to finance any considerable line extensions necessary in giving service. In pre-war times we went to perhaps extreme lengths in making underground and overhead extensions to obtain new business. Nearly 10 per cent of our new capital was expended in this way each year. When the United States entered the war no new capital could be obtained directly, and it became necessary, therefore, for the customer to pay for all except minor extensions. In most cases the money will be entirely refunded. On lighting business the refund was begun at once to the amount of 25 per cent of each monthly bill, and for power extensions the refund will be begun at the conclusion of peace, except in a few cases where the installation was purely for war work, and in these cases the customer will receive only the salvage value of the material.

It is interesting to recall that in 1917 and 1918 nearly 60,000 hp. of new power business for steel industries was connected. The greater part of this may be considered as for direct war production. Indeed, over half of it was for plants devoted entirely to munition manufacture. To be sure, some of it did not get into operation. The largest job of all, that of the Symington Chicago corporation, accounts for 25,000 hp. This plant was to have capacity for forging 15,000 6-in. (15.2-cm.) shells and completely machining 10,000 each day. All the machinery was to be electrically driven and would have had a maximum demand of between 12,000 kw. and 15,000 kw.

Along with these direct power applications we made a very distinct advance in lighting industries. By careful investigation we have been able to prove that the use of enough light will increase the output in almost any sort of manufacturing from 10 per cent to 30 per cent at a cost of from 2 per cent to 5 per cent of the payroll. This sort of efficiency made a special appeal to men engaged on government contracts.

LOS ANGELES PLAN IS CARRIED AT ELECTION

Purchase by the City of the Distributing System of the Southern California Edison Company Is Approved by Voters

A heavy vote was registered at Los Angeles, Cal., on Tuesday of this week on the proposed issue of $13,500,000 bonds by the city for the purchase of the electric distributing system of the Southern California Edison Company. The proposal was carried by 1300 votes more than the necessary two-thirds majority. The question of authorizing the sale of the surplus aqueduct power to the Edison company was also carried, receiving 300 votes over the necessary two-thirds of the total vote cast.

As stated in last week's issue of the ELECTRICAL WORLD, the purchase price is divided between $11,000,000 including the physical valuation and $2,453,067 severance damages for taking the business of the company. For thirty years the city is to purchase from the company power required in addition to that generated in its own plants, the price to be fixed by the State Railroad Commission.

The Edison company retains all of its business outside the city and also the traction load within the city.

MAKERS OF MATERIAL-HANDLING MACHINERY ARE TO MEET HERE

Coalition Meeting to Be Held in New York on June 11 with Three Sessions, Preceded by Conference to Form Advertising Council

All manufacturers of mechanical handling machinery and equipment and accessories in the United States are invited to attend the coalition meeting of the Material Handling Machinery Manufacturers' Association at the Hotel Astor, New York, June 11. This includes all manufacturers of cranes, winches and hoists, elevators, gravity and power conveying machinery and apparatus, industrial trucks, tractors and trailers, bulk-handling machinery, and all makers of equipment and accessories such as storage batteries, bearings, ropes for hoists, buckets, electric controllers and apparatus, etc.

The advertising managers of the companies manufacturing these products are also invited to hold a preliminary conference at the Hotel Astor at 8 o'clock in the evening of June 10. It is planned to form an advertising council of the Material Handling Machinery Manufacturers.

Among the speakers for the day meeting is James H. Collins. Mr. Collins will tell of the many successful results of coöperative promotion and the value to manufacturers of coöperative investigation and educational work.

Francis Holley, director of the Bureau of Commercial Economics, will tell how it is distributing educational and industrial moving-picture films.

A general "forum" discussion will be conducted in the afternoon. All manufacturers will be asked to participate. The discussion will take up ways and means for promoting a more general knowledge of economies which may be effected through mechanical handling of equipment, the value of conserving physical energy, the bearing which modern machinery has on foreign trade and kindred topics.

For the evening meeting a mass gathering is planned. Addresses will be made by Theodore E. Burton, former United States Senator and now director of the Merchants' National Bank, and by Murray Hulbert, Commissioner of Docks, New York.

The committee in charge is: W. J. L. Banham (chairman) of the Otis Elevator Company, Frederick Stadelman of the Wellman-Seaver-Morgan Company, and E. Logan Hill of Heyl & Patterson.

PLANS FOR MEETINGS OF THE ASSOCIATED MANUFACTURERS

Large Attendance Promised for the Summer Section and Other Meetings Scheduled for June 16 to 18 at New London, Conn.

A large attendance is promised for the summer section meetings of the Associated Manufacturers of Electrical Supplies, to be held at the Hotel Griswold, New London, Conn., on June 16 to 18. As reported in last week's issue of the ELECTRICAL WORLD, there will be, in addition to the meetings of the various sections, meetings of the general association and of the international trade committee. In addition to the business matters to be considered at the general association meeting it is anticipated that other subjects of much interest will be on the program.

An indication of the scope of business of the sections is given by the following outline by C. A. Bates, secretary of the Fuse Section, for the meeting of that section, which is to be held at 2 p.m. on June 16:

1. Report of the industry conference on the renewable fuse standard. Final action on this standard will be requested at this meeting.
2. Consideration of a proposed standard on plug fuses.
3. Report of the committee on engineers in reference to recommendations made by the Hydro-Electric Power Commission, Canada.
4. Report of the nominating committee and election of officers for the ensuing year.

GOVERNMENT WAR POWER OVER UTILITIES UPHELD

United States Supreme Court Decides that Authority Given by Congress Is Complete and Federal Government Has Authority on Rates

In a decision rendered on June 2, the United States Supreme Court upheld complete control by the federal government over telephone, telegraph and railroad rates under the war powers conferred by Congress. Justice Brandeis dissented from the majority opinion in the telephone and telegraph rate cases, but on the railroad rate case the opinion was unanimous.

Chief Justice White said in rendering the railroad opinion:

No elaboration could make clearer than do the act of Congress of 1916, the proclamation of the President exerting the powers given, and the act of 1918 dealing with the situation created by the exercise of such authority, that no divided but a complete possession and control were given the United States for all purposes as to the railroads in question. But if it be conceded that, despite the absolute clarity of the provisions concerning the control given the United States and all-embracing scope of that control, there is room for some doubt, the consideration of the general context completely dispels hesitancy.

THE ILLINOIS COMMISSION EXTENDS TEMPORARY RATES

Still Retains Policy of Not Fixing Value on Properties, Holding Instead that Value Is at Least Certain Amount

The terms of some of the temporary rates fixed by the Illinois Public Utilities Commission last year have expired, and extension of the same temporary rates has been granted to the interested companies. None of the present extensions runs beyond June, 1920.

The companies wnich were recently granted extensions are the Southern Illinois Light & Power Company, the Dekalb-Sycamore Electric Company, the People's Power Company, the Logan County Gas Company, the E. G. Light Company and the Lena Electric Light & Power Company. The present policy of the commission in fixing rates is to follow its war-time practice of not fixing values, holding instead that a property is worth at least a certain amount.

AMERICAN ENGINEERING STANDARDS ASSOCIATION

Revision of Constitution of Organization Now Proposed to Carry on the Large Work of the Committee Originally Suggested

A statement regarding the proposed scope of the American Engineering Standards Association has been made by C. B. Le Page, the acting secretary. It is in part as follows:

In many lines of engineering much excellent standardization work had been done before the war. The war emphasized its importance and showed most clearly the need of coöperation to prevent the confusion caused by the promulgation of overlapping standards by independent bodies. During the war the government departments coördinated these efforts in certain lines and greatly assisted in unifying them. The American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers and American Society for Testing Materials, recognizing the value of what had been done, invited the government departments of War, Navy and Commerce to appoint representatives to act with them to continue this work. The body so formed is the American Engineering Standards Committee.

The American Engineering Standards Committee has just completed and adopted a revision of its constitution which has been sent to the governing boards of all the departments and societies represented on the committee with a request for its ratification. The new constitution changes the name to American Engineering Standards Association. The objects are stated as follows:

1. To unify and simplify the methods of arriving at engineering standards, to secure coöperation between various organizations and to prevent duplication of the work.
2. To promulgate rules for the development and adoption of standards.
3. To revise and pass upon recommendations for standards submitted as provided in the rules of procedure, but not to initiate, define or develop the details of any particular standard.
4. To act as a means of intercommunication between organizations and individuals interested in the problems of standardization.
5. To give an international status to approved American engineering standards.
6. To coöperate with similar organizations in other countries and to promote international standardization.

Means are provided for increasing the number of representatives in the association by invitation or on request. Any organizations may request the association to approve standards which it has formulated or to approve committees that it has appointed, and by so doing becomes a sponsor society. At the request of the sponsor, approval of the standards is given when they are the substantially unanimous conclusions of a committee made up as follows:

(a) Sectional committees dealing with standards of a commercial character (specifications, shop practices, etc.) shall be made up of representatives of producers, consumers and general interests, no one of these interests to form a majority. General interests include independent engineers, educators and persons who are neither consumers nor producers, as defined above.

(b) Sectional committees dealing with standards of a scientific or non-commercial character shall consist of persons specially qualified, without regard to their affiliations.

It is anticipated that in nearly all cases the approval of standards and committees by the association will be requested. In case it is considered advisable, the association is authorized to call a meeting of those who would be interested in the formulation of a new standard or the revision of an old one, to select one or more sponsor societies. The sponsor society or societies will appoint a sectional committee to formulate or revise the standard. This sectional committee will report to the sponsor when its work is completed. The sponsor may then request the association to approve. The association deals only with the sponsor and acts only at its request. Provision is made in all publications that a standard must be referred to as that of the sponsor, using whatever title the sponsor has given it, followed by the statement "approved by the American Engineering Standards Association." The approval may be given in one of three ways as "recommended practice," "tentative standard" or "standard," the expectation being that nothing will be approved as standard until it has shown that it is generally acc ptable.

BUSINESS CONFERENCE HELD AT AUGUSTA, ME

Central-Station Representatives Meet Under Auspices of Advertising and Publicity Committee of New England Section, N. E. L. A.

A conference of central-station interests under the auspices of the advertising and publicity committee of the New England Section of the National Electric Light Association was scheduled to be held at the Augusta House, Augusta, Me., June 4 and 5.

The program was as follows:

Wednesday morning, good-will and courtesy meeting; subjects: publicity, various forms, specimens, letters to customers, press advertisements, ways in which employees can show courtesy, educating directors and stockholders. Wednesday afternoon, lighting sales campaign; subjects: old and new house wiring, extension of wiring, plan of outlets, special features, forms of campaigns, specimens. Wednesday evening, Central Maine Power Company "booster" meeting; P. H. Whiting, chairman.

Thursday morning, appliance sales; subjects: special attention to range campaigns, discussion of rates, advantages of electric cooking, specimens of advertising, follow-up letters, booklets of N. E. L. A. Commercial Section. Thursday afternoon, appliance sales and specialties; subjects: vacuum cleaners, lamps, small appliances, coördinate advertising and sales campaign schedule, industrial appliances, bake ovens, etc.

L. D. Gibbs of the Boston Edison company is chairman of the New England Section committee on publicity. It is planned to hold a second conference at Providence, R. I., June 16-18.

SURCHARGE STILL NEEDED, SAYS NEW JERSEY COMPANY

Witnesses at Public Utility Inquiry Assert Higher Costs Make Continuation Necessary if Company Is to Remain in Power Business

Evidence as to general increase in operating expenses and consequent need for larger revenue was submitted by the Public Service Electric Company of Newark, N. J., at hearings concluded this week before the New Jersey Board of Public Utility Commissioners. The commission instituted the proceedings on its own initiative for the purpose of ascertaining whether in the face of existing conditions the war surcharge upon large contracts for electric power should be discontinued or modified.

The commission in February, 1918, allowed the company to make a surcharge of 25 per cent to wholesale customers. Application had been made for a charge of 33⅓ per cent to make up an estimated deficit for the year 1918 of $1,800,000.

The Manufacturers' Council of New Jersey, which opposed the continuation of the surcharge, contended, through its counsel, State Senator Clarence E. Case, that the emergency which the surcharge was originally intended to meet had passed and that if the company needed higher return it should apply for a general increase in rates. It was not fair, he declared, for the wholesale user to stand the entire cost. He also pointed out that the company's gross revenue for 1918 had exceeded estimates made at the time the surcharge was originally granted by $2,300,000, and that continuance of the charge was unnecessary.

Chairman Slocum sustained the contention of the company that the divergence between the estimated and the actual revenue was due not to the surcharge so much as to increased business. The expressed intention of the board at the time the surcharge was allowed was, he said, that wholesale customers who in the board's opinion were getting power too cheaply should pay the increase, and even now, with the surcharge added, he said, this class of business is not paying in proportion to other classes, such as lighting customers.

The company introduced or entered the appearance of twenty-three wholesale users of power, who expressed entire satisfaction with the present rates. In addition, Thomas N. McCarter, president of the company, introduced as evidence approximately 100 letters from wholesale customers expressing willingness that the surcharge be continued. These customers, he pointed out, were some of the biggest manufacturing concerns of the state, their connected load aggregating 28,060 kw. and their payments to the company in 1918 amounting to $1,012,000. Most of the large manufacturers, the company claimed, preferred to pay the surcharge rather than to run the risk of having their power shut off, while those who objected to the charge were comparatively few.

Mr. McCarter and E. J. Allegaert, general auditor of the company, declared that the reason the company wished to continue the surcharge, instead of applying for a general increase in rates, was that the emergency had not yet passed. The high prices of materials, especially of fuel, were here to stay, and no one could tell what would be needed in another year. The company preferred to let the present charge stand until conditions were changed in one way or in the other.

A. S. Lyon, statistician and accountant for the commission, testified that the company's statement for 1918 showed an increase in revenue, including the surcharge, of $2,675,270, or 19.3 per cent over 1917 figures.

Operating costs were much higher in 1918 than in 1917, said Mr. Allegaert. This was due to increases in the cost of coal, labor and materials, which considerably exceeded the estimates. The increase in the item of fuel was the principal source of added expense which made the surcharge necessary. This exceeded even the company's estimates. The cost of coal in 1918 was $5.782 per gross ton as against a figure of $5.41 used in the estimates.

Mr. Allegaert declared that operating cost for 1919 would be even higher than last year. The cost of coal for the rest of the year, based on a careful estimate of coal receipts, was placed at $5.824 per gross ton. The cost for the first four months of 1919 was $6.028, making the average cost for the entire twelve months $5.89 per gross ton as against the $5.72 paid last year.

Mr. McCarter said in effect that unless the company were allowed to make the surcharge it could not afford to remain in the wholesale power business. In his opinion the company must pay dividends of more than 8 per cent to get the funds for needed extensions. It was vitally to the interest of the state, he thought, that the company continue as a wholesale dispenser of power. The power business had lowered the average rate for all sorts of power from 6.5 cents per kilowatt-hour in 1910 to 3.9 cents per kilowatt-hour in 1918. The rate for wholesale power went down also, from 4.3 cents per kilowatt-hour in 1910 to 2.44 cents, surcharge included, in 1918. The basis of cheap power was that it kept the plant going during the day and built up an additional load, said Mr. McCarter.

Mr. McCarter said that if the company continued its power business it would spend in the neighborhood of $6,000,000 a year for extensions amounting on the average to 25,000 kw. for all purposes. If the power business should be abandoned the company would have to install only 6500 kw. per year at an annual cost of $1,500,000. Mr. McCarter placed the gross earnings from the wholesale distribution of power in 1918 at $8,109,000. He said that sale of power represented 65 per cent of the company's business on a basis of kilowatt-hours, while on a basis of income it represented 31.27 per cent.

Among the other witnesses called by the company were L. P. Hammond, president of the Colorado Power Company, and Donald G. Geddes, of Clark, Dodge & Company. Testifying as to the general situation among public utilities, the latter declared that stocks of public utilities were selling, almost without exception, far below par. He attributed this condition to bad credit, which he said was due to higher operating costs. If utilities were to make needed extensions, they must reëstablish their credit, and this could only be accomplished through higher earnings which would leave a surplus after payment of dividends. Mr. Geddes thought the company should have a surplus of 50 per cent after payment of dividends; if an 8 per cent dividend were declared, there should be left a surplus of 4 per cent.

Both sides in the case were directed to file briefs within three weeks, following which the board will give its decision.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 1251 of this number.

Rochester Engineering Society.—The annual meeting and election of officers is to take place on June 13 at 8.15 p.m.

Electric Club of Chicago.—At the May 15 meeting Dr. Morrison described his travels through France and England as the guest of the governments of those countries. Charles N. Wheeler, correspondent of the Chicago *Tribune*, addressed the May 22 meeting.

Physics Conference to be Held at Cornell University.—A physics conference and reunion will be held at Cornell University, Ithaca, N. Y., on June 19 and 20. Among those who will speak are Dr. S. J. Barnett, Capt. Ralph Bown, Prof. George W. Stewart, Dr. Ernest F. Nichols, L. B. Marks, Dr. P. I. Wold, E. C. Crittenden, Dr. C. H. Sharp, Dr. P. G. Nutting and Dr. Wheeler P. Davey.

A. S. M. E., Chicago Section.—On May 29 the Chicago Section of the American Society of Mechanical Engineers held its last meeting of the season. The speaker of the evening was Dr. William S. Sadler, who gave a very interesting address on "Stress and Strain," dealing with physical engineering from the health standpoint. For the coming season these section officers were unanimously elected: A. L. Rice, chairman and G. R. Brandon, secretary.

New York State Association of Electrical Contractors and Dealers.—Arrangements have been completed for holding the annual convention of the association at Saratoga Springs, N. Y., from June 23 to 25. The program of the national association and the advantages of membership will be outlined by W. C. Peet and W. H. Morton. Overhead costs and estimating on construction work will be treated by C. C. Dailey. T. J. Casey will set forth the most modern methods of merchandising and advertising. J. T. Huchings, president Rochester Railway & Light Company, will discuss the effect of lighting company rates for energy on the contracting business. A paper on the channels of distribution between manufacturers and consumers will be read by Samuel A. Chase. Safety-first devices as applied to the national code and relations of the National Fire Protective Association and the Bureau of Standards will be discussed. Relations between jobbers and contractor-dealers will be dealt with by J. J. Raferty. Up-to-date methods of conducting retail stores and advantages of coöperative selling campaigns will be discussed at length. W. L. Goodwin will also speak.

National Electrical Credit Association to Meet.—The annual meeting of this organization will be held on June 13 and 14 at the Hotel Gibson, Cincinnati, Ohio.

National Association of Electric Inspectors.—A meeting of this association is to be held in Springfield, Mass., on Oct. 13 and 14. Thomas H. Day, Hartford, Conn., is chairman of the committee on arrangements.

Joint Meeting in Toronto.—The Toronto Sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers held a joint meeting on May 16. A discussion on the metric system was lead by Dr. E. F. Burton.

Telephone and Telegraph Division, American Railroad Association.—This organization, which was formerly the Association of Railway Telegraph Superintendents, will hold its first annual meeting at the La Salle Hotel in Chicago from June 11 to 13.

Jovian Electric League, Los Angeles.—Dr. Baker P. Lee spoke on "Olympus and Service" at the May 28 meeting of the league, and Charles W. Duncan, sales manager of the Foster & Kleiser Company, gave a short address on "Electricity in Advertising."

George J. Murphy Addresses Electrical Contractors in Boston.—At a recent meeting of the Massachusetts State Association of Electrical Contractors and Dealers at Boston George J. Murphy of the Pettingell-Andrews Company, Boston, spoke on cost accounting, giving an exhaustive explanation of the use of forms and credits. During a brief intermission in Mr. Murphy's remarks M. R. Griffith of the General Electric Company gave a lantern-slide talk on interesting lighting and power installations.

American Institute of Electrical Engineers

Chicago Section.—A. F. Riggs is the new chairman of this section and A. C. King the new secretary.

Baltimore Section.—"The Engineer and the Public" was the title of a talk given at the April 25 meeting.

Ithaca Section.—R. E. Wagner of the General Electric Company spoke on "Electric Arc Welding" at the May 16 meeting.

Spokane Section.—At the annual meeting held on May 16 J. E. E. Royer was elected chairman and Foster Russell secretary-treasurer. The latter also gave a talk on "The Development of the Airplane" at the meeting.

Toronto Section.—The new officers of the section are A. B. Cooper, chairman, and D. M. Fraser, secretary. "Some Voltage Limitations of Current Transformers" was the subject of W. B. Buchanan, who adressed the meeting of April 25.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Extensions Beyond 100-Ft. Limit.—The New York Public Service Commission, First District, rendered recently a decision in the matter of the hearing on motion of the commission concerning the furnishing of gas and electric energy beyond the 100 ft. referred to in Section 62 of the transportation corporation law and the filing and posting of a service provision, rider or form of contract in respect thereto. Its conclusion was that while each case of an extension beyond the 100-ft. limit must be treated upon its own circumstances to determine what would be reasonable, each company should have and enforce such regulations as will insure, first, publicity of the terms and conditions under which an extension will be built and, second, the avoidance of favoritism or discrimination. The commission adopted an order requiring the filing and posting by gas and electric companies of a schedule or supplement setting forth the rules or regulations governing application for extensions of transmission lines beyond the 100-ft. limit in question.

Sale of Energy for Resale.—The New York Public Service Commission, First District, has rendered a decision regarding the complaint of the Acker, Merrall & Condit Company against the New York Edison Company as to the alleged refusal to furnish break-down service. The Edison company contended that the complainant is an "electrical corporation" under the statute, that as such it had no right or authority to sell electric energy to any one outside its building, and that therefore the Edison company should not be required to furnish energy with which the applicant would do an unauthorized and unlawful act. The commission held that a wholesale grocery corporation which generates and sells electric energy to two or three neighboring buildings is not as a matter of law, or necessarily as a matter of fact, engaged in a public calling or comprised within the statutory category of an "electrical corporation." It also disclaimed any belief that the Public Service Commission law relates to every corporation which generates and sells electricity or that every sale of energy is subject to the commission's control. The Public Service Commission law confers jurisdiction over the public calling, the business of selling electricity to the general public as a means of revenue, not the incidental disposal of surplus electrical energy to buildings situated in the vicinity of the plant.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Farmers Demand Repeal of Daylight-Saving Law.—Farmers all over the country are becoming insistent in their demands for the repeal of the daylight-saving law, according to members of Congress from agricultural states. Senator Arthur Capper of Kansas, who expects to take the lead in bringing about the repeal, stated recently that this is the one thing most earnestly desired by farmers of the Middle West. It is claimed that the operation of the law has proved ruinous to the farmers since the extra hour of daylight in the evening is useless to them, as farm laborers insist that their day is over at 6 p.m. and cannot be induced to work after that hour.

Development of Army Searchlamp.—A review of the work of the Army Engineer Corps in the war, first issued by the War Department, says that the corps produced a new form of searchlamp more powerful than any that had preceded it in any army, with which the Second Field Army had been partially equipped. "It weighed," the report says, "one-eighth as much as lamps of former design, cost only one-third as much, was about one-fourth as large in bulk and threw a light 10 per cent stronger than any other portable projector in existence." The engineers were at work when the fighting ended upon a mechanism which would enable them to control searchlamps from a distance.

Engineering Courses Popular.—One of the most popular divisions of education made available to disabled soldiers by the Federal Board for Vocational Education is that of engineering, in the various branches of which there are now 178 students, thus giving refutation to a somewhat prevalent idea that the vocational education available for disabled men is confined to manual trades, or necessarily must be in wage-earning occupations. In this general classification, six men are taking architectural engineering, two chemical engineering, and eighty are preparing to be civil engineers. Electrical engineering takes thirty, general engineering twenty-five, mechanical twenty-two, mining seven, and steam eight. Indicating the character of institutions at which these men are pursuing their education, the following are being used: Harvard University, Massachusetts School of Technology, Franklin Union, Boston; Hawley School of Engineering, New Bedford Industrial School, Saunders Trade School, New York Electrical School, Pratt Institute of Brooklyn, Rensselaer Polytechnic School, Columbia University, Heffly Institute, Lawrenceville Trade School, Carnegie Institute, Pennsylvania State College, Johns Hopkins University, Georgia School of Technology and Colorado State School of Mines.

Coal Jobbers Use Electric Truck.—A. Jackson Marshall, secretary of the Electric Vehicle Section, National Electric Light Association, calls attention to the fact that in Boston, Chicago, New York and elsewhere electric trucks are employed extensively in the movement of coal from the yards to consumers. A study of comparative operating costs indicates that in large cities coal is moved at a lower cost per ton-mile by electric trucks than by any other form of transportation. This fact is being realized by many coal companies, and as a result far-reaching developments are contemplated in the further application of the trucks to this particular class of business.

Welcome Home Reception.—A rousing reception was given at the Dayton (Ohio) Power & Light Company's recreation hall recently for those employees who have returned from the war. More than 300 fellow employees were present to do them honor. The event of the evening was an illustrated talk by Lieut. Howard Tansey, who was with Battery "D" and had some exciting experiences. Other talks by Junior Lieutenant William Shuler of the navy and Lieut. Frank Kendig of the artillery were well received. Three of the company's boys—Ray Collins, G. D. Stivers and Michael Monahan—made the supreme sacrifice for their country in the war, and in their honor the entire assemblage stood with bowed heads for three minutes.

Gross Rate Justified in Massachusetts Opinion.—Gas companies, and inferentially electric companies, according to an opinion by Attorney-General Attwill of Massachusetts, in response to a Senate inquiry, may lawfully, after establishment by the Gas and Electric Light Commission of a maximum net rate to be charged their consumers, establish a gross rate in excess of the net which must be paid by all customers who do not prior to a specified date pay the net rate. The inquiry was whether the action of the commission in fixing a net price prohibits the charging thereafter of a gross price to the consumer who does not pay the charges when due. It is held that the charging of a gross rate is a long-continued practice, acquiesced in by the public and not lightly to be disturbed; that when, by order, the commission deals solely with a net price it contemplates that a gross price in excess will be charged and impliedly authorizes such a charge. It is held that the gross rate must be reasonable and that the difference between the gross and the net rates must have relation to the expense to which the company is put by the failure of the users to pay the net rate when due.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Injury to Trespasser.—In a decision rendered by the Supreme Court of Kansas it was held that a telephone company is not responsible in damages for the death of a thirteen-year-old trespasser who climbs one of the company's poles, equipped with steps for climbing, and is killed at the top of the pole by coming in contact with an overhead uninsulated electric light wire placed, maintained and operated by the city in which the company conducts its business, but over which electric light wire the company has no control (180 P. 271).

Authority of an Agent in Adjusting Lighting Charges.—In the case of an agreement between an electric light and power company's customer and the latter's agent that the agent was to check up and audit customer's bills for light and power between certain dates, for which services the agent was to be paid 50 per cent account by reason of errors or overcharges, the Supreme Court of Oregon has held that the agreement gives the agent the power to agree with the company as to the amount it should repay the customer on account of errors and overcharges and to include authority to make settlement (179 P. 909).

Consulting Engineer Employed Under Retainer.—In a case where a company engaged another to act as consulting engineer at a retainer of $7,500 per year, the Supreme Court of New York has held that the contract was a hiring at will. The opinion of the court (175 N.Y.S. 219) also brought out the following points: (1) Recovery by an employee suing for salary must rest on his proof, and his action fails where he himself introduces in evidence letters between parties showing that employment was at will, and not for a year, as he claimed, and on which theory he bottomed his demand. (2) Where an engineer, in accepting a retainer for a year, stated that he assumed "entire responsibility for the design and construction of" his employer's "new works," the process being a new one in the experimental stage, the engineer did not intend to guarantee sufficiency of plant, but merely agreed to assume full charge of construction and to use his best endeavor. (3) Where the employer at will, though having right to discharge an employee at any time, did not assume to exercise it but offered, in consideration of employee's resignation, to pay him two months' advance salary, the obligation binding on employer resulted on employee's acceptance.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

George W. Lawrence has been elected president of the Turners Falls (Mass.) Power & Electric Company, succeeding Philip Cabot, who has recently resigned. Mr. Lawrence has been general manager of the company since its early hydroelectric expansion began.

Charles M. Cohn, vice-president of the Consolidated Gas, Electric Light & Power Company of Baltimore, has been elected president of the Industrial Corporation of Baltimore City, succeeding John R. Bland, who is now chairman of the corporation's board of directors. The Industrial Corporation is an enterprise which grew out of the Aldred Industrial Survey of Baltimore and has already assisted in the organizing and establishing in Baltimore of industries having an aggregate capitalization of more than $5,000,000 and employing more than 4000 workers. In addition to his connections with the companies mentioned, Mr. Cohn is director and secretary of the Industrial Building Company, director of the Fidelity Trust Company, director of the Arundel Sand & Gravel Company and director of the Hess Steel Corporation.

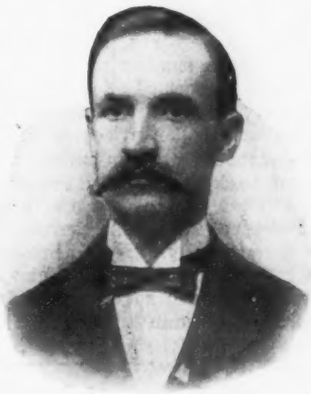
CHARLES E. KNOX

David A. Belden of Haverhill, Mass., on June 1 became associated with the Harry M. Engineering Company, Boston, Mass., in the capacity of vice-president. Mr. Belden was born in Aurora, Ill., about fifty years ago. He was educated at Racine College, Wis. From 1892 to 1901 he was general manager of various electric railways in northern Illinois, following which he became general manager of the Georgia Railway & Electric Company, Atlanta, Ga., where he remained until elected vice-president and general manager of the Birmingham Railway, Light & Power Company, Birmingham, Ala. He held the last-named position until called to New England as president of the group of railway, light and power companies controlled by the New Hampshire Electric Railways. Mr. elden is to continue as executive head and president of the companies with which he is now connected, but he will be less active in matters of operating detail, all of which work will be delegated to the local officials in Haverhill and Portsmouth. He expects to leave Haverhill in the fall and resume his residence in Boston, where he lived until September, 1917.

Obituary

Charles E. Knox, for many years one of the leading consulting electrical engineers of New York City, died June 1 at St. Luke's Hospital from blood poisoning. Mr. Knox was born at Atlanta, Ga., Sept. 17, 1871. After graduating from Columbia University School of Mines in 1892 with the degree of electrical engineer, he entered the employ of Queen & Company of Philadelphia in research work and later took a test course in the shops of the General Electric Company at Lynn, Mass. On Dec. 1, 1893, Mr. Knox became associated with C. O. Mailloux as engineering assistant in general consulting engineering work, and in 1907 the firm of C. O. Mailloux and C. E. Knox was formed. This existed until May 1913, when Mr. Knox opened an office as consulting electrical engineer at 101 Park Avenue, New York City. After that time he devoted his attention to the design of electric light and power equipments for industrial plants, office buildings, hotels, factories and hospitals, department stores and elevator installations. Among the prominent building installations where he acted as consulting engineer on the elevator and electrical equipment are those of the Woolworth Building, the New York City Municipal Building, the Equitable (elevators), the Metropolitan Life, the Travelers' Insurance (Hartford), the Pennsylvania and Commodore Hotels, the R. H. Macy and Abraham & Straus department stores, the Columbia University buildings, Bellevue and Mount Sinai Hospitals and the Metropolitan Museum of Art. During the war Mr. Knox had charge of much government construction work in New York City and surrounding territory. He was a fellow of the A. I. E. E. and a member of the Institute of Consulting Engineers, the New York Electrical Society and many other social and educational clubs of New York City.

George T. Hanchett, consulting electrical and mechanical engineer of New York City, died at the Battle Creek Sanitarium on May 6. Mr. Hanchett, who was born at Hyde Park, Mass., Sept. 4, 1871, was a graduate of the Massachusetts Institute of Technology and prior to 1895 was associated with E. P. Roberts & Company of Cleveland and C. O. Lenz, at that time in Providence, and with the Collyer Machine Company of Pawtucket, R. I., in electrical engineering work. In the fall of 1895 Mr. Hanchett came to New York and shortly after joined the editorial staff of the ELECTRICAL WORLD. He opened an engineering office in New York the following year and was thereafter engaged in consulting engineering work. As a result of experimental investigations on Röntgen rays, induction coils and electrolytic interrupters, Mr. Hanchett established several new principles in the construction and operation of induction coils and published the results of his researches of certain anomalous voltage and current phenomena in electrolytic interrupter circuits. With F. B. Gage he invented and placed on the market a direct-reading ohmmeter. Much of his work was in machine design and invention. He did considerable work for the Murphy Safety Third Rail Electric Company, and the Baltimore plant of that system in the tunnel of the Baltimore & Ohio Railroad was designed and installed under his supervision. In more recent years he was engaged in consulting engineering work for a number of automobile manufacturing companies. A large part of Mr. Hanchett's work was of a varied character, consisting of tests, expert opinions, investigations and the design of special machinery, work requiring much skill and judgment, but not of a kind that brings general professional recognition. Mr. Hanchett suffered a stroke of apoplexy a year ago, and the recurrence of that trouble is given as the immediate cause of his death. He was a fellow of the American Institute of Electrical Engineers and a member of a number of other organizations and was the author of a book on modern electric railway motors. He was buried at Antrim, N. H.



GEORGE T. HANCHETT

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

NO LOWER PRICES SEEN FOR OUTDOOR SWITCHING EQUIPMENT

Prominent Manufacturer Holds that Reductions Will Come Only as a Result of Buying in Order to Distribute Overhead

In a conversation held by a representative of the ELECTRICAL WORLD with a prominent manufacturer regarding price trend of outdoor substation and switching equipment, the manufacturer gave it as his opinion that prices could be lowered if production could be stimulated through buying. If his organization was to be kept together, after so much necessary expenditure to bring it to its present development, it was impossible to reduce the overhead. Consequently, with the low production due to curtailed buying in the last two years, the same overhead had to be distributed over a smaller number of units produced, thereby increasing the cost of each unit. If it were desired to let go of the trained organization over the short period of low production, then prices could be adjusted.

"The economic way to reduce the cost of the apparatus is to get back to quantity production," said the manufacturer. "That means that the power companies must get out of the rut of holding until prices lower. Prices will lower through buying, not through holding off. Peace is about to be concluded, the Victory loan is safely by, and Congress is now in session. This should have some stabiling influence on industry."

TRANSFORMER STOCKS ARE NOW PRACTICALLY NORMAL

Development Work Not Specially Active, but Producers Stand Ready to Build Machines for Continuous Pressures up to 225,000 Volts

During the period of low sales volume which followed the midwinter relaxation of war material production, manufacturers of transformers utilized the opportunity to build up stocks, and these are now practically normal. Prompt deliveries can be made on distribution transformers of standard design. On "power" transformers deliveries are now about as good as can be expected in view of the painstaking care necessary in building high-class units.

Generally speaking, the higher-voltage equipments require increased time in the factory for the proper handling of the insulation problem, and from two to three months is still requisite for the shipment of transformers of this class or of the larger sizes designed to meet special conditions and not ordinarily carried in factory stocks. Rush orders are now and then put through in shorter periods, but the design and construction of transformers which will withstand severe over-potentials due to surges and other causes is a problem requiring such technical skill that the time allowances above outlined represent conservative practice and should not be curtailed except for extreme needs.

While development work is not specially active at this time, it is noteworthy that transformer builders stand ready to produce equipment capable of continuous operation at pressures up to 225,000 volts. Line difficulties appear to be the limiting factor in present transmission engineering, decided advances having been accomplished within the last three or four years in dissipating the effects of excessive voltage peaks and interwinding strains in transformer equipment itself.

GROWING MARKET FOR ELECTRIC DRINK MIXERS

Sales, Already Large, Expected to Increase Considerably, as a Result of National Prohibition, After July 1

Electric drink mixers, so far as can be learned, are experiencing a greater sale than ever before. This is due, it is thought, to the establishment of many new soft-drink parlors. One of the largest manufacturers of drink mixers reports that it has not been able to anticipate this demand, because last year the War Industries Board declared drink mixers non-essential and prohibited their manufacture until after the signing of the armistice.

Current demand is steady and shows no signs of letting up, and there is every indication to believe that there will be a steady increase in business for some time. As one manufacturer put it: "A man accustomed to an alcoholic beverage will not be satisfied with the plain soft drink served at the soda fountain, but he will want fancy mixed drinks. The call, therefore, for this class of drink after July 1 will be very insistent, and it will be impossible to meet it except by means of the electric drink mixer."

Furthermore, history has shown that whenever prohibition has gone into effect the number of soft-drink parlors in the district has increased very rapidly and considerably. Prohibition, therefore, should offer a greatly increased market for drink mixers.

No changes in price have occurred since the first of the year, so far as could be learned.

COPPER AND BRASS PRODUCTS TO REACH A HIGHER LEVEL

Advances in Steps of About One Cent Each Expected to Bring Rubber-Covered Wire Up to 25-Cent Base or Better in the Fall

Within the past month buyers have seen copper products such as wires and brasses advance on a rise of a little more than one cent in the copper market. Indications are that this is but the first of a series of rises to last well into the fall months.

In spite of the fact that there are immense stores of copper available, current quotations may be considered as a bottom level. Current prices are not to be taken as any indication of the relation between supply and demand. Psychology rather than the old laws of economics governs the present market.

Copper has been steady now for a couple of weeks. Just as soon, however, as any consumer demand develops prices will advance again, and they will continue to advance just as long as buying continues. When buying begins to ease up prices will be stationary. There is no indication that a slump in buying will be accompanied by a falling market.

Advances will probably be made in steps of about one cent at a time. The upper limit which should occur in the fall is expected by those in a position to forecast more or less accurately to reach and perhaps exceed 20 cents. That would put rubber-covered wire on a 25-cent base or higher.

GOOD MARKET FOR RANGES AND CLEANERS IN SOUTH

High Cost and Scarcity of Labor Have Been an Impelling Motive in Leading Southern Women to Turn to Labor-Saving Electrical Devices

Cheap colored help is no longer available to hold back the use of electrical household devices, especially those of the labor-saving variety, in the Southern States. Many of the colored servants of the South have either gone North in search of high wages or are able to live at home on the wages of some other members of the family. As a result, domestic help has become so scarce and expensive in many localities that large numbers of Southern women are now compelled to do their own housework, and electricity is taking the place of the colored servants. Colored cooks were not very successful in the operation of electric ranges, but now this range is coming into its own, and the demand for it as well as for the many socket devices used in the home is steadily growing.

METAL MARKET SITUATION

Few Price Changes—Market in General Is Stronger than It Has Been of Late

Metal prices of the past week have undergone little change. Electrolytic copper has held at 16.37½ cents, while prime Lake has eased off ¼ cent and casting copper has stiffened ⅛ cent to 16 cents. Spelter is slightly easier.

The two holidays of the past week, coming at the end of a month and following some hot weather, had a quieting effect on the metal market. The market is strong, however, and gains in bookings all along the line have been noted. The removal of copper import restrictions by France is regarded as an encouraging sign and intimates progress in the consumption of her own red metal. Italy has lifted her embargo on iron and steel and may soon do so on copper.

Domestic consumption of copper is increasing, and there is prospect of further increasing consumption in the next few months. At the same time foreign consumption is increasing, and the outlook in that direction looks better every week. However, it is expected that production of mines, smelters and refiners will not be increased, so that the prospect for reducing accumulations is encouraging.

The lead market is at present dull. There is an increasing consumption, however, for storage-battery and lead-covered cable use.

The scrap-metal market has been looking up of late. Heavy copper and wire scrap is the only item reported stronger in price, and it, with brass turnings, has found an encouraging market.

NEW YORK METAL MARKET PRICES

	May 27	June 3
Copper:	£ s d	£ s d
London, standard spot	78 15 0	79 5 0
	Cents per Pound	Cents per Pound
Prime Lake	17.00	16.75
Electrolytic	16.37½	16.37½
Casting	15 87½	16.00
Wire base	18.00 to 18.50	18.00 to 18.50
Lead, trust price	5.25	5.25
Antimony	8.37½	8.37½
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Spelter, spot	6.57½	6.50
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	32.00 to 33.00	32.00 to 33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	14.00 to 14.25	14.50 to 14.75
Brass, heavy	8.00 to 8.50	8.00 to 8.50
Brass, light	7.25 to 7.75	7.25 to 7.75
Lead, heavy	4.50 to 4.60	4.50 to 4.60
Zinc, old scrap	4.50 to 4.75	4.50 to 4.75

THE WEEK
IN TRADE

BUSINESS generally last week was smaller owing in large part to the holiday. Demand, however, is increasing, particularly in wiring supplies. Appliances show a continuation of large sales and fans are beginning to move with the season's first real warm days. There seems to be a hesitation, however, on the part of dealers to lay in sizable stocks. Glowing reports of electric sewing machines come in from almost every section of the country.

Stocks for the most part are in good shape with the exception of flexible armored conductor, which is in very short supply.

Construction of dwelling houses and store repairs and remodeling are going ahead rapidly and are absorbing quantities of wire, wiring supplies and fixtures.

Collections are reported as being in good shape. Few new credits are being placed.

NEW YORK

The national holiday of last Friday and the impromptu holiday so generally observed on Saturday had the effect of slowing up trade for that week. However, the jobbing business for the month of May was generally in good condition, with great expectations for the near future.

Iron conduit and fittings have continued quiet, while flexible armored conductor is still shy in the market. Power cable and rubber-covered are moving better. The warm weather has had some influence on the fan market, but in general not what it should have.

In New York City there is a noticeably large amount of store-window alteration, calling for the requisite number of receptacles, conductor and lighting fixtures. Outside the city there has been found real evidence of home building of five-thousand-dollar to eleven-thousand-dollar houses. These are not necessarily community affairs but private enterprises.

CONTROL EQUIPMENT.—Controlling apparatus for industrial motor work is picking up in good shape. In the return to peace work there is sufficient time now for correct application of remote control. There is a better market reported for battery-charging control, as there is more attention being paid to electric truck delivery needs. Theater dimmers are in better demand, not only for new houses but for better lighting control of older houses which could not be supplied during the war.

FANS.—There have been some warm, 90-deg. and 92-deg. days recently, and still many dealers are withholding fan orders. Where they have been required to take ten fans when placing their contracts with jobbers, they have done so, but there is still a lack of repeat orders. One jobber however, reported no stocks of one make of 16-in. direct-current oscillating fans, and no quick factory deliveries. Consequently he was in the market for several hundred of another make. There has been found a quite general policy among jobbers to absorb the excise fan tax. Sales of 32-volt fans are reported better than last year.

ELECTRIC NOVELTIES.—The market for toys and novelties is in good condition and a better season than heretofore is expected. Not only is the domestic trade good but the foreign business is improving. Prices are firm.

BOXES.—Knockout boxes for iron conduit have been found off 4 points. Some sources attribute this to the poo market and unstable conditions.

MOTORS.—Some few orders for large motors have come in, but in general this end of the motor business is quiet. Sizes up to 10 hp. are finding a fair market. New York

stocks of squirrel-cage motors of these smaller sizes are good and much better than those of direct-current motors.

FLEXIBLE ARMORED CONDUCTORS.—Some jobbers are practically out of stock. Deliveries to them are only percentages of their orders.

FRICTION TAPE.—Regardless of the recent advance of cotton, there has been reported no advance in price of friction tape.

WIRE.—Rubber-covered base averages the same as last week, namely, 21 cents. The only change reported is from 18 to 20 cents by one producer. Sales are picking up right along.

CHICAGO

Prices seem to be holding steadily with a few exceptions. The movement in prices is of such a nature that it is difficult to see a trend; however, the curve seems to be bending slightly upward at the present time. Jobbers report that the volume of their business for the first five months of this year is practically equal to that of last year, although in the month of May the 1919 business hardly equaled that of May last year, because May last year was a remarkable month.

A trip through the outlying towns in Illinois and Indiana shows the observer where the large quantity of small orders, which the jobbers have reported as replacing the larger war-order business, are coming from. In every small community people are building new residences, additions to old residences and small factories of a varied nature. It is this activity which in the aggregate is producing the volume of the business that the trade is enjoying to-day in construction material. Building permits for Chicago in the week ended May 31 totaled $1,546,450 and included permits for 142 small residences and apartments out of a total of 163 building permits. This situation also reflects that which exists throughout the outlying territory. In addition to this there are reported buildings projected totaling $3,795,000, out of which total $1,420,000 will go into apartment buildings.

The labor situation has been disquieting to some extent. Organized workers in some localities, especially Chicago, appear to be able to obtain their demands regardless of the justice of what they ask. A part of the spirit of unrest which prevails is thought to be reflected from the general Canadian situation.

Reports of government sales of materials of various kinds of goods are becoming more frequent.

COPPER WIRE.—The base on rubber-covered and weather-proof copper wire has been increased to 21 cents by Chicago jobbers, as of June 2.

CONDUIT.—The demand is somewhat better, the reflection of building conditions being apparent in the movement of this commodity.

FANS.—Electric fans have begun to move rapidly out of jobbers' stocks, and a good fan year is predicted if the warm weather which began within the last few days is continued.

HOLLOW WARE.—No especial buying has been noticed to fill the usual June demand.

DRY BATTERIES.—There has been no change in the price of dry batteries.

SCHEDULE MATERIAL.—The market is active in small-order business.

BOSTON

Business continues in good volume as to both commodity turnover and sales. Deliveries and collections are in the main very satisfactory. Prices do not show any great change, barring advances of about 10 to 12 per cent this week in covered wire. A scarcity of armored flexible conduit is still reported in this district. Building permit applications at Boston are about 43 per cent in excess of a year ago, garages predominating. At Hartford, Conn., building permits since Jan. 1 total over $4,000,000. At Springfield, Mass., it is estimated that the city is $10,000,000 behind its normal building expansion as a result of the war. About $3,500,000 in new building work will be done there this year, compared with about $1,600,000 in 1918. At Bristol, Conn., 400 cottages and a hotel are to be built this season. Labor conditions are somewhat unsettled in the southern Massachusetts textile area. The Western Electric telephone repair shop strike at South Boston was unsettled Monday, when a hearing was given by the State Board of Arbitration upon the situation and when conflicting claims were presented as to the amount of work available for suspended employees.

FANS.—Jobbers are well stocked for early fan business. Some of the larger distributers have purchased their estimated summer requirements, but many smaller dealers are not yet ordering. As yet no preference in type or size is noted, but it is expected that by another month the demand for 9-in. and 12-in. units will greatly exceed other calls.

ELECTRIC TABLEWARE.—Trade is brisk and stocks are being well maintained. Prices are holding firm.

WIRE.—Flexible armored conductor is running short in New England, as last week's market review indicated. Weatherproof wire is up 1 cent to a 21-cent base, and slow-burning wire is up 1 cent to 21.5 cents. Bare wire is steady at 19 cents and rubber-covered wire is up to a 21-cent base. Building operations are calling for large quantities of smaller-sized wire in central Massachusetts and Connecticut, compared with last year.

POLE-LINE HARDWARE.—The demand shows a tendency to increase. Prices are steady. Central-station expansion is proceeding slowly but surely and the market benefits accordingly.

IRON CONDUIT.—The demand varies considerably from week to week. Some stocks are low as to smaller diameters, but a good deal of pipe is now coming into New England. Prices are a little unsteady, with wavering tendencies from week to week.

WASHING MACHINES.—Business is booming, and small indication of a let-up can be seen. Price considerations appear to cut little or no figure in sales. This is also true of vacuum cleaners.

PORTABLE LAMPS.—Despite daylight saving, trade in portable lamps continues to be unusually good. These outfits are increasingly popular as gifts. Prices have been pretty well maintained so far, and little artificial stimulus of trade through cuts has been necessary.

FUSES.—The demand is far below the supply available. Rumors as to a price increase appear to be without foundation.

FARM-LIGHTING SETS.—Considerable summer residence business is being booked. Trade is well distributed throughout New England and eastern Canada, and deliveries range from stock on smaller sets to from two to four weeks on larger outfits. Prices hold firm.

WIRING MATERIAL.—The demand appears to have slackened a little, temporarily. Prices are firm and material plentiful. The report that key sockets are going to a 30-cent list price appears to be unreliable.

MOTORS.—General motor business is featureless, with a fair turnover, considering the moderate amount of industrial construction under way. A brisk demand for printing-press motors is evident. Motor deliveries range from stock to six weeks on press drives.

ATLANTA

The market for all lines of electrical supplies and equipment is becoming more active, and increases in the demand for many items are a feature in trade this week. The building boom that started several months ago is still unabated, and the number of building permits and values is growing from day to day. Activity in schedule material is further

stimulated by a widening of trade channels for this material. Specialties of all kinds are enjoying a remarkable demand. Sales show a substantial increase over the corresponding period of 1918, and prospects are bright for a still bigger volume.

LAMPS.—Although the volume of business shows a slight decrease over last week, sales to date are running well ahead of last year, owing largely to an increased demand for larger units for street lighting. Eastern shipments are prompt and Southeastern stocks are well filled. There is no apparent shortage in any size.

METERS.—Manufacturers and wholesalers report an increasing demand from all central stations, which is particularly noticeable from the smaller municipalities. The market is stimulated by the great activity in residence and apartment construction. Prices remain firm and deliveries good.

TRANSFORMERS.—The call for power types has slackened, owing to inactivity of the industrials in marketing large extensions and the inability of power companies to offer large blocks of energy. The 2300-volt distributing types are moving fast. The lack this year of government orders which were a feature this time yast year is offset by the increased purchases by central stations. Deliveries are normal.

MEASURING INSTRUMENTS.—This item has been practically dormant for some time because manufacturers have not had the men available to push it.

SWITCHBOARDS.—Inquiries are numerous, but bona-fide transactions are disappointing. Nothing but a revival in industrial construction and extensions can materially improve the market. Equipment for small central stations is the only encouraging feature. Shipments have been greatly reduced.

WIRE.—The demand is increasing daily through the activity in construction and the call from central stations to handle small extensions. Prices saw no change over last week. Deliveries are good.

FANS.—An increasing temperature following the cool wave of last week has started a brisk movement of fans, and dealers are preparing for the rush later on. Stocks are in god condition.

PANELBOARDS.—The demand for this item has slowed up during the past two weeks, but with a firm price and no indications of an early change manufacturers are looking forward to a more active market shortly. Shipments are averaging two weeks.

MOTORS.—One manufacturer reports a readjustment of prices, which means a reduction running as much as 10 per cent on certain capacities. The call for sizes above 1 hp. continues moderate. Stocks are attaining their normal condition.

RECTIFIERS.—Jobbers and dealers report an active market. This line is being strongly pushed, which accounts for the present stimulation in sales. Factory shipments remain about the same with the exception of isolated longer deliveries.

SEWING MACHINES.—As a result of dealer and jobber effort the sale of these have shown a marked increase, and the present outlook points to a continued active market.

SEATTLE—PORTLAND

The volume of jobbers' business continues about the same as last week. Sales are light. Shipyards and allied industrial plants are buying only when necessary, awaiting official confirmation from Washington that canceled contracts will be renewed or that new contracts will be let. Dealers in Seattle, especially, report good business during the past week. Sales of domestic appliances showed a slight increase over last week, while house-wiring devices made a material increase. This is accounted for by the fact that during the month of May approximately 1400 wiring permits were issued.

Construction projects contemplated for Seattle during the summer will total nearly $10,000,000 in value. The value of building permits for the year to date about doubles the record of the first five months of last year. More optimistic authorities state that Seattle and the Northwest are on the high road to greater prosperity and industrial development in the immediate future, in spite of present unsettled conditions.

The Portland district reports no material change in conditions over last week. Business continues fair with no marked changes of any kind. A number of important things are under consideration, but nothing of really definite nature has come to the surface to date.

POLE AND LINE MATERIAL.—The work of caring for replacements, maintenance and general wear and tear is practically completed. Pole and line equipment sales are exceeding expectations, although they were not very heavy. Jobbers' stocks are in good shape.

MOTORS.—A good supply is now reported in standard equipment. Prices are firm with no increase in sight. Logging and lumbering interests contemplating electrifying continue to send letters of inquiry. These are followed in some instances with orders of considerable proportions.

ELECTRIC SEWING MACHINES.—Activity in this line increased during the past week. Established lines moved with increased rapidity. Stocks are in excellent condition and prices remain firm.

COLLECTIONS AND CREDITS.—In Seattle, Tacoma and Portland collections are reported as very good. In a lesser degree this can also be said of the rural districts served directly by these metropolitan centers. New credits of any importance are few and far between.

SAN FRANCISCO

More and more the contractor-dealer is becoming a dealer-contractor. This is due to a variety of causes, but principally to a nation-wide campaign by big manufacturers and jobbers and the promotion of a better spirit of merchandising among dealers. During the present year the Pacific Coast has seen more contractors turn into real electrical merchants than has been the case for a decade of years previously, and this tendency is intensified by the California Coöperative Campaign.

WIRE.—Rubber-covered wire has increased slightly owing to a slight change in the base of copper, the change being very slight in the standard sizes and more in the nature of a price adjustment. The same increase in copper has raised the price of weatherproof wire 50 cents per 100 lb., this being the first advance reported after many months of decline.

LAMP CORD.—The comparatively small quantity of copper in lamp cord in proportion to its total price has occasioned no change in the price because of the slight increase above noted, but heater cord has been refigured and the market is about 10 per cent less than previously.

INSULATORS.—The largest styles of porcelain strain insulators have increased in price about 20 per cent. Several big jobs are reported, with a keen scramble among competitors, who once again, after several years, have the stimulus of actual jobs upon which to figure.

INSULATING MATERIAL.—Although the market is not what it was in 1918, there is a very good demand, and the result of the unusual year has been that the complete insulating line is more generally distributed among jobbers than previously. Orders are consequently spread about more. Tape prices have been put on a new basis, generally speaking, in which the maximum quantity has been cut in half and the best price increased by about 10 per cent.

SEWING MACHINES.—The discovery of new factors in sewing-machine distribution, such as concessions for old machines and the like, has caused a change in long-standing prices, and vibrating models now generally retail on the Coast at $47 each and rotary styles at $57 each, an advance of more than 10 per cent.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges or account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	5%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$100.00
Coil to 1000 ft	82.50
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to list
1/5 to std. pkg	List to 20%
Std. pkg	23% to 36%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
½-in. single trip	$75.00	$63.75— 69.75
½-in. double strip	75.00— 82.50	72.00— 75.00
¾-in. single strip	100.00	85.00— 93.00
¾-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
½-in. single strip	$75.00	$63.25 to $63.75
½-in. double strip	78.25	71.25
¾-in. single strip	100.00	75.00 to 85.00
¾-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
3/16	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
3/16-in.—	$25.00	$20.75	$21.50
¼-in.—	30.00	21.50	20.50

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
3/16-in.	$33.00	$17.50	$16.25
¼-in.—	36.00	19.00	17.25

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
¾	.17
1	.23
1¼	.27½
1½	.37½
2	.58½
2½	.76½
3	

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
¾	.13	.37
1	.17	.45
1¼	.21	.50
1½	.28	1.10
2	.40	1.80
2½	.60	4.80
3		

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 12.1%	6% to 14.1%
2500 to 5000 lb.	9% to 15.1%	11% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3% to 6.1%	+1% to 8.1%
2500 to 5000 lb.	2% to 11.1%	4% to 13.1%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$7.00 to $7.50
Discount	25%

CHICAGO

List price	$6.35 to $7.50
Discount	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $8.75
1/5 to std. pkg.	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$8.00
1/5 to std. pkg.	7.00

Standard packages, 500. List each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.01–$35.18
Coil to 1000 ft.	25.94– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00
Coil to 1000 ft.	21.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–33%	10%–24%
$10.00 to $50.00 list	30%–45%	20%–32%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.00 to $22.40
1/5 to std. pkg.	12.00 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$17.85–$24.15
1/5 to std. pkg.	14.70– 21.00

Standard pkg., 2200. List per 1000, $20.00 to 21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
		5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg.	10.50– 11.20	15.35– 18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
		5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$13.60–$18.40	$27.20–$36.80
1/5 to std. pkg.	11.20– 16.00	22.40– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg.	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20 to list
1/5 std. pkg.	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-qmp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	23%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 33%	24% to 25%
$2.00 to $10.00 list	30% to 33%	24% to 25%
$10.00 to $50.00 list	30% to 45%	25% to 30%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$7.00
Discount	30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.40–$0.41
No. 18, full spools	.35– .38

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.46
No. 18, full spools	.41

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.15–$14.50	$10.50–$12.65	$10.50–$10.60
12	18.54	18.54	13.90
10	24.96	24.96	16.64
8	34.02	28.35	22.68
6	53.94	44.95	35.96

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$17.50–$18.50	$9.50–$10.00	$8.90–$10.00
12	22.05	22.05	18.90
10	29.68	29.08	25.44
8	40.39	34.62	24.62
6	63.84	54.72	54.72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$25.00–$29.25
25 to 50 lb.	25.00– 25.25
50 to 100 lb.	24.00– 23.25

CHICAGO

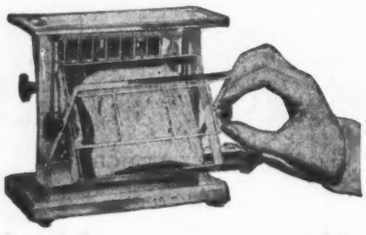
	Per 100 Lb. Net
Less than 25 lb.	$24.50 to $24.75
25 to 50 lb.	24.50 to 24.75
50 to 100 lb.	24.50 to 24.75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Reversible-Rack Electric Toaster

When one side of the bread is toasted properly in the electric toaster now being manufactured by Manning, Bowman & Company, Meriden, Conn., a knob on the side of the holder or rack



TURNING THE KNOB TURNS THE TOAST OVER

is turned and the untoasted side of the slice is turned toward the heating element. The toaster, which is rated at 475 watts, accommodates two pieces of bread at a time and has knobs at each side of the holders. The knobs or handles are ebonized and non-heating. The toaster can be supplied either with or without a rack on its top to hold six slices of bread. The finish is nickel plate, and the base is furnished in either black enamel or nickel plate. Each toaster has a detachable plug, 6 ft. (1.8 m.) of cord and lamp-socket connections.

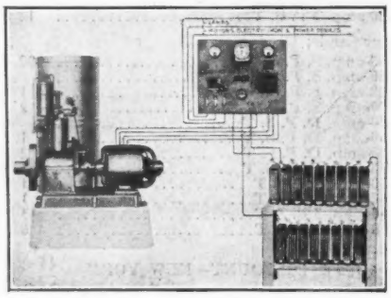
Glare-Eliminating Commercial Lighting Unit

To eliminate glare, the necessity for frequent cleaning and absorption or loss of light in the diffusing medium, the New Era Manufacturing Company, Leader-News Building, Cleveland, Ohio, has developed the New Era lighting unit. The fixture is said to be highly efficient and to give maximum candle-power on the plane of illumination. An important feature in the unit pointed out by the maker is the distribution of light on the walls. While the unit does not cast a brilliant light on the ceiling, thereby showing up discolorations and making frequent cleaning of the ceiling necessary, it does provide a light which entirely eliminates the harsh, sharply cut-off lines on the walls which are encountered in some fixtures.

Three styles of the unit are obtainable—pendent, decorative and porcelain-enameled. A replacement type for attachment to existing connections, a close ceiling type for low ceiling outlets, and the pendent type, including plain and decorative chain fixtures, may be obtained.

Semi-Automatic Farm-Lighting Plant

The switchboard equipment of the semi-automatic farm-lighting equipment being manufactured by the Globe Electric Company, 193 Broadway, Milwaukee, Wis., is provided with an ampere-hour meter with contacts at full charge and at 75 per cent of discharge. When the battery is fully charged the engine is automatically stopped, and when the battery is 75 per cent discharged the circuit is automatically opened, cutting off lights or any other devices that may be on the circuit, thus giving a signal to recharge the battery. This arrangement always insures a sufficient amount of reserve power to crank the engine. The



LIGHTS ARE CUT OFF WHEN BATTERY IS THREE-QUARTERS DISCHARGED

engine can be started at places remote from the installation.

The generator develops 32 amp. at 35 volts and is designed for charging sixteen storage cells. The engine, made by the Western Engine & Dynamo Company, Milwaukee, Wis., is of the four-cycle water-cooled type and provided with a thermo-siphon circulating tank. A vacuum system permits the use of a large fuel supply tank, which may be placed outside of the premises in which the engine is operated and below the level of the engine floor, thus preventing any danger of fuel leaking.

The engine is provided with a power pulley and has sufficient reserve power to permit charging the batteries at normal rates and developing about 1 hp. on the belt. It is provided with a throttling governor and shows a variation of less than 3 per cent from no load to full load.

The switchboard is provided with a counter-cell switch which cuts in one or more counter cells on the lamp circuit while the battery is being charged. An extra terminal for a power circuit is provided on the switchboard so that maximum voltage may be obtained while the engine is charging the batteries for the operation of an electric iron or motors, as these devices always require maximum pressure and are not subject to injury from the rise of voltage required for fully charging storage batteries.

Ammeter with Range 30-0-30 Amp.

The "Universal" V. P. ammeter, which has been brought out by the Roller-Smith Company, 233 Broadway, New York City, may be used on farm-lighting plant switchboards to indicate the condition of the batteries, and in addition it is applicable to all makes of automobiles, all types and makes of electric lighting and starting systems and all voltage systems. With the many different cars on the market and all the different type and voltage systems with which they are equipped, there is a need for a more suitable ammeter, since the ordinary ammeter, designed for lighting circuit work, will not operate under conditions where the ammeter must be installed in the cranking circuit. The new ammeter, the maker declares, will operate satisfactorily under any condition, being particularly designed for cranking circuit use. It has a scale with a range of 30-0-30 amp. and is of the flush type with a black finish. The diameter of the body is 2 in. (5 cm.); the over-all diameter is 2⅝ in. (6.6 cm.), and the depth behind the flange is ⅞ in. (2.2 cm.). S. A. E.

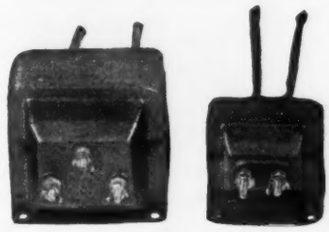
INDICATES WHEN BATTERY IS CHARGING OR DISCHARGING

standard mounting holes are supplied. Each ammeter is furnished with a full supply of mounting screws and nuts and washers.

Bell-Ringing Transformer with Low Core Loss

The line of bell-ringing transformers just placed on the market by the General Electric Company of Schenectady, N. Y., are designed for high efficiency, core losses being exceptionally low. Careful attention has been paid to avoiding any hum. All current-carrying parts are completely surrounded by steel, thus meeting Underwriters' requirements, so that no additional steel box for inclosing the transformer is required in the installation.

There are nine of these transformers, all having standard ratings and divided into two general classifications. The household type is intended for the ordinary signal systems found in residences.



SUPPLIED IN HOUSEHOLD AND HEAVY-DUTY TYPES

The heavy-duty types are for larger and more powerful signal systems in office buildings, hotels, apartment houses, mines, industrial plants, etc. The household-size transformer is built in three ratings—for 110 volt, 50-140 cycle service; for 220 volt, 50-140 cycle service, and for 110 volt, 25-49 cycle service. The heavy-duty types are made in nominal rated capacities of 50 and 100 watts. Three secondary voltages are provided in these sizes, on account of diversified requirements met with in this class of installations.

The transformers are finished in green enamel. The parts in these transformers are also available for other transformers, such as toy transformers, special relay auto-transformers, etc.

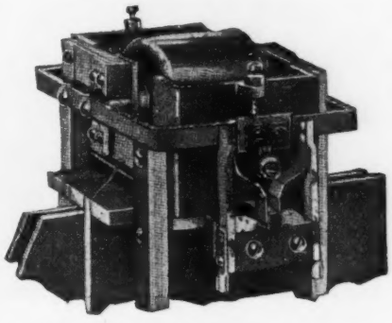
Unit-Type Interior-Illuminated Signs

The customary electric sign does not usually have the same advertising value in the daytime as in the night since the letters outlined in exposed lamp bulbs are not readable from any great distance owing to their lack of contrast with the background. This disadvantage is not present in the Oplex porcelain enamel unit signs which the Flexlume Sign Company of 1443 Niagara Street, Buffalo, N. Y., is manufacturing, since the white, glossy letters contrast well with the dark, high-finish background of porcelain enamel. As their name implies, these signs have a unit construction, that is, each letter is a separate and interchangeable part of the sign, so that the legend or words may be changed without the expense of a new sign. A durability resembling that of a bathtub is obtained in these signs because they are finished in porcelain enamel, which is impervious to heat, cold, moisture, grease and dirt.

The signs have a framework of heavy galvanized steel. The faces are composed of individual unit plates of heavy steel, finished in blue porcelain enamel with white trimmings and with white backs, which helps the illumination. In each place is a stencil or opening through which projects the raised opalescent glass letters, held in position by small, rust-proof bolts. The letters are illuminated by lamps in the interior of the sign directly behind each one. The bulbs are accessible through small doors in the top or bottom edges of the sign. Standard 12-in. (30-cm.) letters are supplied, and for extra lettering on the sign illuminated 4-in. and 6-in. (10-cm. and 15-cm.) letters on unit panels are also procurable.

Reverse-Current Relay for Direct Current

A reverse-current relay for direct current which is suitable for mounting on circuit breakers or directly on busbars or cables has been placed in the market by the Albert & J. M. Anderson Manufacturing Company, Boston,



CAN ALSO BE MOUNTED ON CIRCUIT BREAKERS

Mass. It is claimed to be absolutely uninfluenced by currents in neighboring conductors, regardless of the intensity or direction of the stray magnetic fields they produce.

This relay consists of two magnetic circuits of laminated transformer steel, surrounding the conductor of the circuit to be protected, and a powerful electromagnet. The ends of the latter are between the terminals of the two laminated transformer steel circuits. Each end of the electromagnet with its corresponding laminated steel circuit forms a powerful polarized relay, and the two are made to operate in unison by rigidly fastening the core of the electromagnet on a pivoted carriage which carries the relay contact.

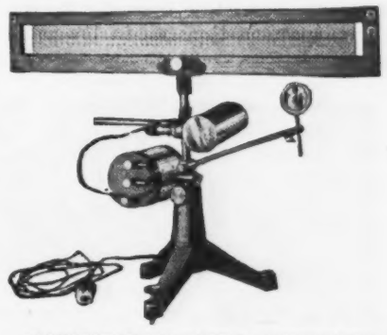
The action of either of the laminated magnetic circuits with the corresponding end of the electromagnet core is that of a reverse-current relay, of the ordinary type, which is susceptible to any stray magnetic fields in the neighborhood. However, any stray magnetic field which influences the pull of the electromagnet on one end counteracts itself by its influence on the opposite end, and the instrument as a whole behaves as though the stray field did not exist. The laminated magnetic circuits are very sensitive to low values of reverse current, and relays built for circuits of 14,000 amp. to 16,000 amp. are said to operate perfectly on reversals of less than 1 per cent.

Lamp and Scale Reflection Indicator

The lamp and scale reflection indicator now being made by the Pyro-electric Company, 636 East State Street, Trenton, N. J., is designed for use with wall galvanometers, or any sensitive laboratory instrument where the deflection is noted by the movement of a mirror fastened to the moving element. The parts are standardized as far as practicable, care being taken to employ the parts of automobile headlights as regularly sold.

Referring to the illustration, the projector, it will be seen, allows for both vertical and horizontal side adustment. It is so designed that lamps of bayonet base, single or double contact, or miniature screw base, may be used. The transformer supplied is designed for a primary voltage of 110 volts, 60 cycles, and its secondary has three terminals giving 6, 9 and 15 volts, with a capacity of 40 watts on the 15-volt circuit and proportionate current capacity for the other terminals. The outfit is thus adapted for any type of automobile headlamp up to 1¼-in. (3.1-cm.) diameter. As the lamp is inserted sidewise there is no distortion of the image due to the interference of the tip, no light from the end of the lamp being used for illuminating. The projector is fitted with a lens which renders the rays from the lamp parallel and evenly illuminates the indicator design in the fore end of the projector; that is, the end nearest the instrument.

Two indicator designs are supplied with each equipment, one giving a



ADJUSTABLE VOLTAGE TRANSFORMER ENERGIZES LAMPS

sharp black line and the other a white line on a black background, such as is suitable for use with vibration galvanometers. The billiance of the spot is determined by the type of lamp em-

ployed and the size of the mirror on the galvanometer. With the ordinary 6-volt gas-filled lamp supplied with the equipment and a $\frac{1}{8}$-in. (5 mm.) mirror, the spot is easily focused and made sharply visible in bright sunlight, though when slightly shaded from direct outside illumination, the spot is very distinct for 30 ft. to 50 ft. through a wide angle, rendering the indicator suitable for lecture demonstration.

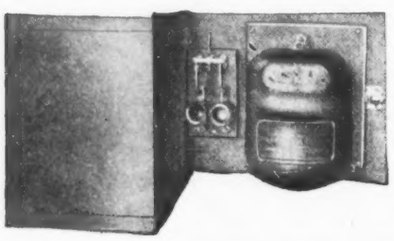
The adjustable arm carries a lens which may be adjusted in all directions. The function of this lens is to define the image sharply on the translucent scale, marked off in millimeters.

Safety Box for Outside Meter Reading

So that meters may be read and "blocked" or sealed from the outside of a building instead of from the inside the Electrical Manufacturing Company, 4149 East Seventy-ninth Street, Cleveland, Ohio, is making a safety meter box which is set in a hole cut through the wall of the house. The meter can be read or sealed regardless of whether the occupants of the building are in or not and at any time. This obviates the all too frequent annoyance of having the meterman track dirt or slush through the house in his passage to the meter installed in a dark cellar.

The box is made with a space in its exposed side for reading the meter dial. The rear side of the box holds the meter, the switches, the fuses and the entrance for the cables. Testing the meter is done from the inside of the building, but "blocking" it can be accomplished by an authorized person from the exterior.

Unsightly, dust-catching meter boards with exposed wiring and unprotected switches and fuses are eliminated with a consequent removal of fire hazard and electrical shock danger. In addition to its safety the box is proof against damp, water and rust. Three types of boxes are obtainable for one or two meters. One has a flange extending around its front part for covering uneven or ragged edges of the opening in the wall made to receive the box. The second style is for installation on the wall in the interior of the basement or on the outside of



METER IS READ THROUGH OPENING IN FRONT SIDE

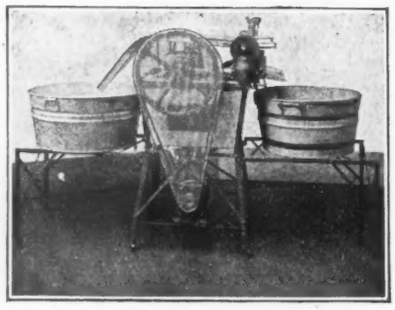
the building and is provided with angle lugs to offset it from the wall. The third type is the same as the second but does not have angle lugs and is for use in the foundation of buildings.

Heavy-Duty Deep-Bowl Reflectors

For general exterior and interior illumination, heavy-duty deep-bowl reflectors are being manufactured by the Henkel & Best Company and distributed by the Federal Sign System (Electric), Lake and Desplaines Streets, Chicago. They are heavily enameled in green on the outside and white inside. The fittings are heavy and will withstand hard usage. The reflector shell is clamped between thick leather washers, in turn held between a slotted metal washer and lock nut on the outside and a flanged fitter on the inside. Substantial studs, locking the position of fitter and socket, prevent these from turning as regards the reflector. The liberal-sized lock nut prevents maltreatment of the reflector, which is thus protected from corrosion and chipping off of enamel.

Electric Washer with Simultaneously Operated Wringer

A double folding tub stand has recently been added to the Wonder electrically driven clothes washer made by the Victor Manufacturing Company of Leavenworth, Kan., and all gears and the pulley wheel have been inclosed. It is now an easy matter, the maker



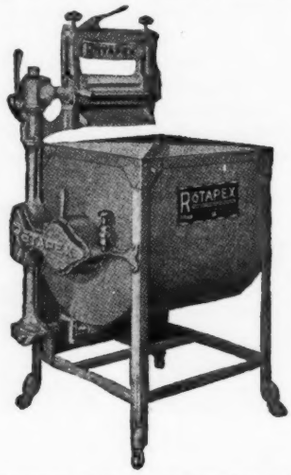
WRINGER AND WASHER MAY BE OPERATED AT SAME TIME

says, to wash a tubful of clothes and at the same time be wringing back other clothes from the rinse water to the bluing water without the two operations interfering with each other. The wringer control is placed on the side of the machine, making it possible for the operator to control the wringer with the left hand and have the right hand free for handling the washing. This does away with the necessity for reaching across the machine to control the wringer.

This washer may be had with "Armco" galvanized-iron tubs, cold-rolled polished-copper tubs or standard stave-leg wood tubs—all being of six-sheet capacity. The agitator is the same in all three styles. A $\frac{1}{3}$-hp. electric motor connected to the ordinary lighting socket furnishes power to operate both washer and wringer at the same time. The two-roll reversible wringer has a malleable-iron frame, ball-bearing inclosed gears and a reversible water board. One convenient feature of the washer is that the power need not be shut off before the clothes are to be removed from the tub since raising the cover automatically disconnects the gear and removes danger of accidents.

Zinc-Cylinder Washing Machine

Because its light-weight cylinder is easily removable the tank of the "Rotapex" electric washer, recently de-



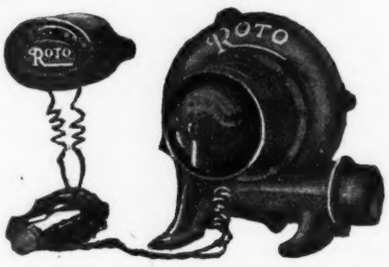
A FRICTION CLUTCH PREVENTS DAMAGE FROM OVERLOAD

veloped by the Apex Electrical Manufacturing Company, Cleveland, Ohio, can be thoroughly cleaned. The zinc cylinder is driven by means of a $\frac{1}{4}$-hp. motor with a high starting torque. A friction clutch prevents damage through overloading.

There are four units of control, namely, the motor with friction clutch, the worm-and-gear power transmission, the cylinder-operating mechanism and the winged control. Each of these units may be disengaged without disturbing the other. The cylinder-operating mechanism is practically noiseless in action.

Air-Cooled Blower

Because its motor is entirely inclosed the "Roto" blower made by the Rosewater Electric Company, 5516 Kinsman Road, Cleveland, Ohio, may be used in places where coal dust, ashes



AIR DRAWN AROUND MOTOR COOLS IT

and other dirt are present. It may be employed to create forced draft in connection with hot air, steam or hot-water furnaces, or it may be utilized for blowing and ventilating purposes.

As the motor is placed in a jacket shown in the illustration, the air is drawn in around it and thus cools it. This jacket also adapts the blower for removing foul air from rooms and replacing it with fresh air.

The regulator supplied with the blower permits draft regulation from distant points; for instance, it may be placed in one of the upper rooms of a house where the blower and furnace are downstairs. In this way the temperature can be controlled without necessitating a trip to the cellar.

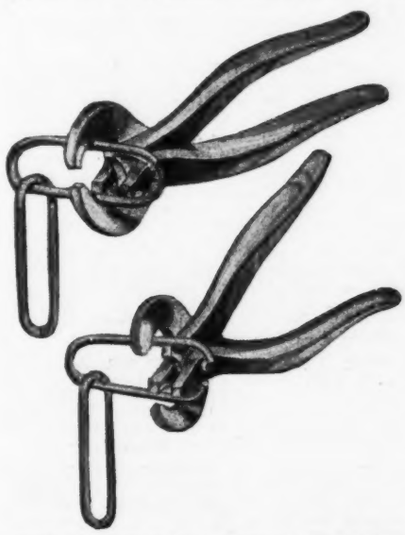
The blower and its regulator are supplied fully wired and can be connected by the plug with any lamp socket. They are furnished for 110 volts or 220 volts, alternating or direct current.

Single and Double-Pole Switch of Insulating Composition

"Rubber substitute," a non-elastic insulation composition, similar to hard rubber in appearance and heat-proof to 160 deg. F. (71 deg. C.), is the material used in manufacturing the Keystone single-pole and double-pole switches now being placed on the market by the International Insulating Corporation, 25 West Forty-fifth Street, New York City, and Mechanic Street, Springfield, Mass.

One-Hand Chain Pliers

The chain pliers which have been developed by the Lightning Chain Tool Company, Lathrop Building, Kansas City, Mo., open and close a chain link in one operation. After opening the link the pliers hold it for inserting or taking out another link or for attaching it to a lighting fixture and then



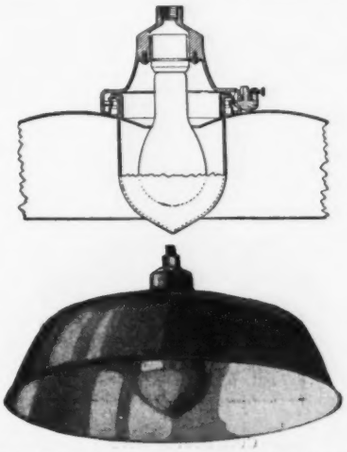
HELD IN ONE HAND; OPENS AND CLOSES CHAIN LINK IN ONE OPERATION

by a continued pressure of the hand the link is freed from the inner jaws and closed with the outer jaws. The tool, which is operated by one hand, is small and compact enough to fit the pocket, but because of its peculiar construction is said to be very powerful, so that opening and closing a chain link can be accomplished with little exertion.

Glareless Industrial Lighting Unit

Elimination of glare is said to be accomplished in the industrial lighting fixture recently placed upon the market by the Central Electric Company, 316 South Wells Street, Chicago. The shade is designed so that the reflection of the filament itself is not directed to the working plane. Moreover, there is no specular reflection between the angles of 0-45 deg. and 50-90 deg.

The unit is equipped with a dust-proof globe formed of glass, the upper half of which is clear. In combination with the reflector the cap eliminates



FILAMENT REFLECTION DIRECTED AWAY FROM WORKING PLANE

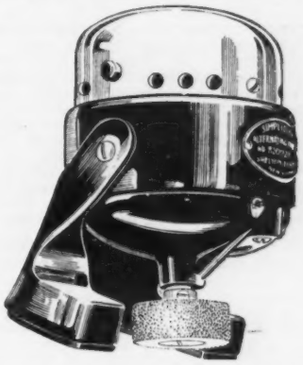
heavy shadows and makes drop cords unnecessary. A cast-iron set-screwless holder is provided with a lock clamp which permits quick and easy adjustment. It is claimed that the reflector cannot loosen under the most severe and continuous vibration.

Silk and Parchment Shade Portable Lamps

Especially designed for nurseries, bedrooms, etc., the "Dolly Dimple" lamps manufactured by Ferdinand Bing & Company, 67 Irving Place, New York, are decorated in natural colors. They can be made to match any decorations and are finished with silk or parchment shades. The framework is of cast metal and forms a substantial lamp.

Electric Motor for Phonograph

The electric phonograph motor operating in direct contact with phonograph turntables which has been developed by the Shelton Electric Company, 30 East Forty-second Street, New York City, is mounted vertically so that the rubber-tipped wheel on the motor spindle revolves the edge of the turntable. An automatic switch is furnished so that to start the phonograph it is only necessary to release the brake and rotate the turntable with the hand. To



OPERATES PHONOGRAPH BY DIRECT CONTACT WITH TURNBUCKLE

stop the motor the turntable is stopped either by the phonograph brake or with the hand.

This motor, known as the "Simplicity," can be used with Edison, Victor and Columbia phonographs. It is supplied either for direct current of 100 to 125 volts or for alternating current of 100 to 125 volts, 60 cycles. Being completely inclosed and insulated, any possibility of giving a shock while handled is avoided. A separating plug is inserted in the length of cord about 10 ft. (3 m.) from the motor, adding to the convenience permitted by the use of the motor.

NOTES ON RECENT APPLIANCES

Safety Electric Lantern

The Federal Sign System (Electric) of Lake and Desplaines Streets, Chicago, Ill., has placed on the market a safety electric hand lantern.

Adjustable Plier Wrenches

There are five wrenches in the series of adjustable plier wrenches which are being marketed by A. C. Allan, 6441 Eggleston Avenue, Chicago, Ill.

Electrically Driven Pressure and Vacuum Pumps

Several models of electrically driven pressure and vacuum pumps are now being marketed by the Utility Compressor Company of Detroit, Mich.

Electrically Driven Profiler

For producing duplicate irregular parts from sheet metal the Oliver Instrument Company of Adrian, Mich., is manufacturing an electrically driven profiler.

Vacuum-Cup Washing Machine

A single vacuum-cup electric washing machine known as Wayne No. 50 has been placed on the market by the Wayne Manufacturing Company, St. Louis, Mo.

Trade Notes

BRITISH IMPORT RESTRICTIONS.—The War Trade Board announces that it has been informed that the Controller of Import Restrictions of Great Britain has issued notice that British import licenses will be issued admitting into Great Britain automobiles up to 50 per cent of the number (or shipping measurements) of the quantity imported up to Sept. 1, 1913. Under this ruling the term "automobile" covers motor vehicles of all kinds, including cycles and accessories. Electrical equipment is included in accessories.

BRITISH LAMP MANUFACTURERS ORGANIZE.—There has been formed recently the Electric Lamp Manufacturers' Association of Great Britain, Ltd. The objects, according to the *Electrician* of London, "include the promotion and protection of the interests of manufacturers of and dealers in electric lamps in the United Kingdom, the carrying on of research work for improving electric lamps, the formation of agreements between members and wholesale and retail dealers in electric lamps relating to manufacture, supply and sale of such lamps, etc."

MOTOR MANUFACTURER SUES VICTOR TALKING MACHINE COMPANY.—A Sherman law suit was begun on May 16 in the federal court at New York by the Shelton Electric Company against the Victor Talking Machine Company for triple damages aggregating $1,317,937.50, on a complaint charging that the defendant sought to deprive it of the benefits of its business as a dealer in phonograph motors. It is charged in the complaint that the Victor company compels dealers in its production to sign a contract which provides that no part of the Victor machine shall be taken out and replaced by any device not made by that company. By means of this contract, it is charged, the Victor company seeks to create a monopoly in electrically driven phonographs.

THE FORD MICA COMPANY, INC., is now at 14 Christopher Street, New York City.

THE HAAG BROTHERS COMPANY, washing-machine manufacturers, Peoria, Ill., has made arrangements for the construction of a new factory in East Peoria. This factory will permit the company more than to double its output. The company expects to be in the new building by Sept. 1. B. H. Lupton in the future will look after the sales end of the business.

F. J. RILEY has joined the organization of Fred W. L. Fullerton, Inc., of 15 West Twentieth Street, New York City, as a power engineer, and will devote his energies to caring for the concern's rapidly increasing business in electric motors, with its growing demand for expert service on power problems. Mr. Riley has been a power man for ten years, seven years of which he spent in the Western Electric Company organization and three years with the Eck Dynamo & Motor Company.

THE LEEDS & NORTHRUP COMPANY of Philadelphia has opened a pyrometer sales and service department in charge of Henry Brewer at 1304 Monadnock Block, Chicago. The announcement reads: "Service to pyrometer users and to prospective users will be rendered from this office. A complete standardization equipment will be maintained. Certification of thermocouples and of pyrometer equipments will be furnished in terms of standards certified by the United States Bureau of Standards. Particular attention will be given to maintaining equipment after installation."

THE EUREKA VACUUM CLEANER COMPANY of Detroit, Mich., expects to complete its new factory about July 1. In this plant there will be manufactured every part that goes into the making of the Eureka machine. The building will be three stories high and cover an area of over 19,000 sq. ft., with a floor space of over 50,000 sq. ft. An immense amount of up-to-date equipment will be installed to make possible the manufacturing of 1000 cleaners per day. At the present time the company, according to a statement from Fred Wardell, its president, is more than 12,000 machines behind, owing to the fact that it was swamped with orders since the war.

THE POOLE ENGINEERING & MACHINE COMPANY, Baltimore, Md., has removed its general sales office from Baltimore to 50 Church Street, New York City. W. C. Tyler, formerly district manager at New York, has been appointed general sales manager in charge of all the selling activities of the company.

E. B. LATHAM & COMPANY, New York City, announces as of June 1 the removal of its supply business from 4 Murray Street to the Tower Building, 326 Broadway. The offices and salesrooms will be at the 550-552 Pearl Street entrance and the warehouse at the 94 Worth Street entrance. All retail sales will be discontinued.

COL. DOUGLAS I. McKAY has been elected president of the Pulverized Fuel Equipment Corporation of 30 Church Street, New York, to succeed John E. Muhlfeld, who retires to return to consulting engineering practice. Since July, 1917, Colonel McKay has been engaged in war work. Leaving business at that time, he was commissioned major in the Ordnance Reserve Corps in charge of the raw-materials branch of the gun division and purchased all raw and semi-finished materials used by the Ordnance Department and contractors for the Ordnance Department. In January, 1918, he was promoted to be lieutenant-colonel in the National Army and appointed assistant director of purchases and supply. Here he had supervision over the purchasing operations of the several supply corps of the War Department, including the Ordnance Department, Quartermaster's Corps, Medical Corps, Corps of Engineers and Signal Corps. He was subsequently promoted to be colonel. Colonel McKay is a graduate of West Point and a former police commissioner of New York City. Upon resignation of the commissionership he became assistant to the president of J. G. White & Company, Inc., and two years later was elected vice-president and director, which position he held at the time he entered the service.

COL. D. I. M'KAY

GEORGE HOYT COX has been appointed New England district manager of the Westinghouse Electric & Manufacturing Company, with headquarters at 10 High Street, Boston. Mr. Cox is well known in the central-station field. He was born in Maine in 1880 and spent his early childhood at Taunton, Mass., being educated at Bristol Academy. In 1898 he entered the central-station field and was employed in the municipal lighting plant at Taunton, passing through all the intermediate grades to and including superintendent. Prior to becoming permanently connected with the Taunton plant Mr. Cox was for about a year a draftsman in textile machinery work, and he also was on the construction staff of the General Electric Company for a short period. Before leaving Taunton, also, he made a number of voyages to Europe on vessels of the Atlantic Transport Line, in connection with the reconstruction of marine electrical installations. In 1912 he became a supply salesman in the Boston office of the Westinghouse company, and in 1915 was made manager of the supply department, which position he filled until he was appointed district manager.

Trade Publications

ELECTRIC SIGNS.—The electric signs made by the Flexlume Sign Company of Buffalo, N. Y., are the subject of a recently issued twenty-four-page booklet.

FIRE-ALARM SIREN. — The Sterling motor-driven siren fire alarm is the subject of bulletin No. 12 from the Interstate Machine Products Company, Rochester, N. Y.

INSULATING MATERIAL.—"Micabond" electrical insulating material is dealt with in catalog No. 26 of forty-eight pages, distributed by the Chicago Mica Company, Valparaiso, Ind.

AUTOMATIC ELECTRIC COOK STOVE. —The Allmur Manufacturing Company of Marion, Ind., describes its automatic electric cook stove in a sixteen-page booklet of recent issuance.

ELECTRIC FANS. — The Knapp 8-in. "Handy" electric fan is the subject of a circular issued by the Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York City.

PIVOTED BUCKET CARRIER.—Catalog No. 210, a cloth-bound ninety-four-page book about the Jeffrey pivoted bucket carrier, has just been published by the Jeffrey Manufacturing Company of Columbus, Ohio.

GRAPHIC METERS.—The latest issue of the Esterline Graphic is entitled, "Tangible Results" and shows the advantages of graphic records in industrial plants and in central stations. The leaflet may be obtained from the Esterline Company of Indianapolis, Ind.

ELECTRIC HOUSEHOLD APPLIANCES.—The Edison Electric Appliance Company, 5660 West Taylor Street, Chicago, is distributing a broadside in colors showing in a condensed form reproductions of the national advertising being done this spring by the three divisions of the company.

WIRING SUPPLIES, SPECIALTIES, ETC.—The Metropolitan Electric Manufacturing Company, Boulevard and Fourteenth Street, Long Island City, N. Y., announces that a series of thirteen bulletins covering its entire line of products is now ready for distribution. Two booklets, form No. 100, covering fuses, and form No. 101, covering wiring devices, may also be had.

New Incorporations

THE LION ELECTRICAL APPLIANCE COMPANY of New York, N. Y., has been incorporated by E. Miller, B. Seidman and R. J. Kupferman, 239 Penn Street, Brooklyn. The company is capitalized at $25,000.

THE S. O. S. WELDING CORPORATION of New York, N. Y., has been incorporated with a capital stock of $200,000 by V. D. Borst, W. A. Rosenbaum and J. E. Zelenko, 1 Park Row, New York City.

THE COLERAIN (N. C.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $1,500 by Estus White, L. B. Perry and C. B. Morris, all of Colerain. The company proposes to do a general utility business.

THE BURGLAR STARTER & BATTERY COMPANY of East Orange, N. J., has been incorporated by H. H. Picking, H. O. Geyer and E. R. Coburn. The company is capitalized at $50,000 and proposes to manufacture electrical equipment.

THE NORFOLK POWER-APPLIANCE CORPORATION of Norfolk, Va., has been incorporated with a capital stock of $25,000 to deal in power appliances, auto-tractor business, etc. The officers are: Paul F. Mueller, president, and J. W. Hough, secretary, both of Norfolk.

THE PEERLESS BRASS SPECIALTY MANUFACTURING COMPANY of New York, N. Y., has been incorporated with a capital stock of $25,000 by R. J. Kupfermann, 329 Penn Street; B. Seidmann, 127 Powell Street, and E. Miller, 1954 Sixty-fifth Street, Brooklyn. The company proposes to manufacture electric and gas appliances.

New England States

ASHLAND, ME.—The local electric light plant, owned by George H. Mooers, was recently destroyed by fire, causing a loss of about $10,000.

FAIR HAVEN, VT.—The Tair Brothers Creamery Company has awarded a contract to the Western Vermont Power & Light Company for furnishing electricity to operate the new ice manufacturing and refrigerating machinery to be installed in its plant.

ATTLEBORO, MASS.—Plans are under consideration for improvements to the street-lighting system in the business district.

BOSTON, MASS.—A budget system has been established by the Boston Elevated Railway under which the company plans to expend $21,500,000 for improvements during the next five years. Among the improvements listed are the construction of a new car shop, the installation of a new turbine, rotary and stokers at the Lincoln power station, completion of the Somerville substation, installation of two rotaries in the Charlestown station, the provision of necessary conduit and cable construction, additions to the signal system, etc.

BROCKTON, MASS.—Contract has been awarded by the George E. Keith Company for the erection of a new one-story power house, 60 ft. by 70 ft., at its plant to Wescott & Mapes, 207 Orange Street, New Haven, Conn.

SHREWSBURY, MASS.—The installation of electric street lamps on North Quinsigamond Avenue is under consideration by the Selectmen.

WORCESTER, MASS.—The New England Power Company is planning extensions and improvements to its power plant and distributing systems, involving an expenditure of about $1,000,000, this year. The proposed work will include enlarging the power station at Vernon, Vt., and the installation of waterwheels and generators, increasing the generating capacity by 15,000 hp., the erection of additional substations, and also connecting the present system, which covers central and western Massachusetts and a large portion of Connecticut and Rhode Island, with the Metropolitan Board of Boston by erecting a feed line into and from the stations of the Edison Electric Illuminating Company of Boston.

COVENTRY, R. I.—The Narragansett Electric Lighting Company of Providence has been granted a franchise to erect a high-tension transmission line from Hope to Coventry Center to supply electricity to the plant of the Rhode Island Processing Company.

WESTERLY, R. I—Bids will be received by the Board of Water Commissioners, Westerly, until June 12 for construction of pumping station and equipment for same for sewerage system. Plans and specifications may be obtained at the office of the Water Commissioners, Town Hall, Westerly, or at the office of Samuel M. Gray, consulting engineer, Grosvenor Building, Providence, R. I. Thomas McKenzie is engineer of water department.

BRIDGEPORT, CONN.—The Nichols Underwear Company, 395 James Street, is planning to build a power house in connection with its proposed plant.

Middle Atlantic States

BELLMORE, N. Y.—Steps have been taken by the Board of Trade of Bellmore to secure the installation of an electric system in Bellmore. The Nassau Light & Power Company of Mineola has offered to extend its transmission lines from its main plant direct to Bellmore, provided that sufficient subscribers are procured from Bellmore, Wantaugh, Seaford, Merrick and Smithville to warrant the expenditure for the extension.

BORDER CITY, N. Y.—The Empire Gas & Electric Company of Geneva has purchased a site adjacent to its local plant, on which it proposes to erect a terminal and pumping station, equipped with two motor-driven pumps having a daily capacity of 2,500,000 gal.

BROOKLYN, N. Y.—Plans have been filed for the erection of a six-story factory building to be built by H. W. Cotton, Inc., on the entire block front on Fourteenth Avenue, between Thirty-sixth and Thirty-seventh Streets. The building will be 80 ft. by 800 ft., and will cost about $100,000. The company manufactures machinery. The Fred T. Ley Company, 19 West Forty-fourth Street, is contractor.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

LEROY, N. Y.—The Board of Water and Light Commissioners is considering the installation of an ornamental lighting system on Main Street, to be maintained by underground wires.

NEW YORK, N. Y.—Plans, it is reported, are being prepared by Sanderson & Porter, engineers, 52 William Street, New York City, for a new plant for the Andes Copper Mining Company at its works at Parquito, Chile, to cost, with equipment and machinery, about $1,000,000.

NEW YORK, N. Y.—Arrangements, it is understood, are being made by the New York Telephone Company for new construction work in New York City, to include new central-office installations and additions to existing installations, to cost about $12,000,000; station and outside plant equipment, about $9,300,000; a new toll board, about $1,125,000, and for completion of additions to central office equipment, about $950,000.

NEWARK, N. J.—The Public Service Electric Company is contemplating extensions to its electric power plant at Point-No-Point, to cost about $80,000.

NEWARK, N. J.—The L. E. Waterman Company, 191 Broadway, New York City, has acquired property on Peddie Street, near Johnson Avenue, on which it proposes to erect a six-story factory, 260 ft. by 475 ft.

NEWARK, N. J.—The Independent Lamp & Wire Company, 1733 Broadway, New York City, has acquired a site on Runyon Street, between Hillside and Belmont Avenues, on which it proposes to erect a new four-story building, 260 ft. by 580 ft. The present works of the company are located at Weehawken.

NEWTON, N. J.—The Public Utility Commissioners have granted the Newton Electric & Gas Company permission to erect an electric transmission line from Dover to Newton, to enable it to secure electricity from the New Jersey Power & Light Company. The cost of the proposed line is estimated at about $40,000.

PERTH AMBOY, N. J.—The Park Commissioners have recommended the installation of electric lamps in both Caledonia and Washington Parks.

PERTH AMBOY, N. J.—Plans are under consideration by the Board of Aldermen for equipping the municipal electric light plant to supply electricity for industrial purposes. The cost is estimated at about $60,000.

TRENTON, N. J.—Permission has been granted to the Trenton & Mercer County Traction Corporation to place all its heavy transmission lines in conduits which run along Lincoln Avenue from the power station.

CARLISLE, PA.—Bids are being taken by E. C. Beetem & Sons for the construction of a new power plant, 40 ft. by 46 ft. W. E. S. Dyer, Land Title Building, Philadelphia, is architect.

EAST BRADY, PA.—The Clarion (Pa.) Electric Company is reported to be considering the construction of a hydroelectric power plant in East Brady.

MILTON, PA.—A one-story power house, 50 ft. by 100 ft., will be erected in connection with the new factory building, 100 ft by 400 ft., at the local works of the Susquehanna Silk Mills, 149 Madison Avenue, New York, N. Y.

PHILADELPHIA, PA.—The ordinance recently introduced in the City Council for a proposed municipal loan of $14,750,000 for improvements, it is understood, provides that $300,000 of this amount will be used for electrical bureau construction, including extensions and improvement.

TYRONE, PA.—The Altoona & Logan Valley Electric Railway Company is considering extensions to its local electric power plant, to cost about $500,000.

BALTIMORE, MD.—Plans are being prepared by Samuel T. Williams, engineer, 223 North Calvert Street, Baltimore, for the construction of a power plant in the western part of Virginia.

HAGERSTOWN, MD.—The Hagerstown & Frederick Railway Company is reported to have purchased the property of the Northern Virginia Power Company, operating a large power plant at Millville, W. Va., and furnishing electricity for lamps and motors in Winchester and Berryville, Va., Charlestown, W. Va., and Hancock, Md. The company also has a steam generating plant at Berkley Springs and a hydroelectric plant at Capon on the Great Capon River in West Virginia. A company has been formed under the name of the Shenandoah Company, capitalized at $100,000, to take over the holdings of the Northern Virginia Power Company. The officers of the new company are: J. J. Houck, president, and E. H. Wade, secretary and treasurer.

CHARLESTON, W. VA.—Bids will be received by the State Board of Control, Charleston, until June 14 for the construction of sewage treatment works for the Weston State Hospital, Weston. The proposed work includes the erection of a sewage pumping station, equipped with two electric motors, two centrifugal pumps and automatic control equipment, and construction of a sewage sedimentation tank, sprinkling filter, sludge bed and chlorinating plant. Plans and specifications may be obtained at the office of J. S. Larkin, membor of State Board of Control, Charleston, or at the office of Charles E. Collins, consulting engineer, Drexel Building, Philadelphia, Pa.

HAMPTON ROADS, VA.—Contract has been awarded by the Navy Department, Washington, D. C., to Post & McCord, 101 Park Avenue, New York, N. Y., for the erection of additional buildings at the local airplane station, at $519,500.

HAMPTON ROADS, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 11 for the installation of electric distribution system at the local submarine base, to cost about $60,000.

HAMPTON ROADS, VA.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C,. for the construction of additional buildings at Hampton Roads, including an administration and torpedo storage building, a storehouse, machine shop, an electrical shop and battery storage building, a subcharging and compressor building, two subcharging buildings and a railroad, to cost about $325,000 (Specification 3909). Plans may be obtained upon application to the chief of bureau of yards and docks, Navy Department, Washington, D. C. A deposit of $30 will be required.

WASHINGTON, D. C.—Bids will be received at the offic of the First Assistant Postmaster General, Washington, D. C., until June 19 for furnishing and installing mechanical equipment, including plumbing, heating apparatus, electric conduits and wiring, and interior lighting fixtures for the United States post office garage, to be located at First and G Streets, N.E., Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until June 10, Mare Island, Cal., Schedule 4056—two motor generator sets and switchboard. Until June 17, South Charleston, W. Va., Schedule 4066—one oxygen hydrogen electrolytic generating plant. Until June 20, Washington, D. C., Schedule 4063—seamless copper tubing. Until June 10 Great Lakes, Schedule 4082—one 1½-hp. motor, one 2½-hp. motor and one 10-hp. motor; Schedule 4072—two 5-kw. direct-current motor-generators, two switchboard panels, one feeder and one generator. Gloucester, N. J., Schedule 8048½—fifty-six switchboards. Mare Island, Cal., Schedule 8049½—one boiler-feed pump, one feed-water heater and two tubular boilers; Schedule 8050½—Miscellaneous stranded cable; Schedule 8051½—eighteen watt-hour meters, one switchboard and equipment, turbo-generators and spare parts and one voltmeter. Application for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—Plans have been prepared by A. Kahn, architect, Marquette Building, for the erection of a steel-manufacturing plant for the Detroit Seamless Steel Tube Company, Jefferson Avenue West and Nineteenth Street. The cost of the plant is estimated at $3,000,000 and will include three manufacturing units, 90 ft. by 550 ft., heating plant, 70 ft. by 100 ft., and a two-story administration. building.

MARQUETTE, MICH.—Bids will be received by the City Commission at the

office of the city purchasing agent until June 16 for improvements to the municipal hydroelectric power plant as follows: (1) Construction of hydroelectric power house, 49 ft. by 97 ft., including tailrace excavation; (2) a reinforced-concrete surge tank, 30 ft. in diameter and 60 ft. high, including foundation; (3) concrete foundations with timber saddles for a wood-stave pipe line, 90 in. inside diameter, 1800 ft. long and 78 in. inside diameter, 285 ft. long. Separate bids to be submitted on power house and penstocks. Plans and specifications may be obtained at the office of Charles Retallic, superintendent of the Department of Light and Power Department, upon deposit of $25 for each set. Thomas W. Orbison of Appleton, Wis., is consulting engineer.

PORT HURON, MICH.—The City Council has approved the resolution to install ornamental lamps on several streets of the city, at a cost of about $19,000. The Port Huron Gas & Electric Company has the contract for street lighting.

CINCINNATI, OHIO.—The installation of ornamental lamps on McMillan Street from May Street to Woodburn Avenue and on Gilbert Avenue from Gilbert Avenue viaduct to Locust Street is under consideration by the City Council.

CINCINNATI, OHIO.—Preparations are being made for the erection of a large theater at the corner of Seventh and Vine Streets. A large amount of electrical apparatus will be required. The plans as now prepared call for thousands of electric light bulbs for exterior decorations. Ascher Brothers of Chicago, Ill., are interested in the project.

CLEVELAND, OHIO.—Plans have been prepared by the Leonard Electric Manufacturing Company, 433 Champlain Avenue, for the erection of a factory at 3907 Perkins Avenue, to cost about $60,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until June 13 for installing and pulling electric wire cables for filtration plant, division pumping station, division of water. Bids will also be received at the same time and place for weatherproof copper wire; also for a boiler-feed heater, both for the division of light and heat.

HAMILTON, OHIO.—The City Council has adopted an ordinance providing for an issue of $17,000 in bonds for improvements to the municipal electric light plant.

MARTINS FERRY, OHIO.—An election will be called on Aug. 12 to submit to the voters the proposal to issue $450,000 for extensions to the municipal electric light plant and waterworks system.

MINERVA, OHIO.—Bonds to the amount of $50,000 have been voted for the construction of a municipal electric light plant.

OAK HARBOR, OHIO.—The Northwestern Ohio Railway & Power Company of Toledo, it is reported, will place contracts at once for the construction of carhouse and repair shops at Oak Harbor.

SOUTH BEND, IND.—The Studebaker Corporation, it is stated, will expend $8,500,000 this year on plant expansion, instead of half of that amount this year and half next year as originally planned. The output of the plant will be more than doubled. A. R. Erskine is president of the company.

BELVIDERE, ILL.—The Rockford & Interurban Railway Company of Rockford is contemplating the construction of a new power plant in Belvidere. The construction of a new line from Belvidere to Rockford is also under consideration.

CARLOCK, ILL.—The construction of a 6600-volt transmission line from Hudson to Carlock and the erection of a distribution system in Carlock is under consideration by the Carlock Light & Power Company.

CHICAGO, ILL.—The Premier Electric Company, 1123 South Michigan Avenue, has purchased a site at the corner of Ravenswood Avenue and Grace Street, on which it proposes to erect plant.

CHICAGO, ILL.—The Packard Motor Car Company has taken a lease on a site at Thirty-seventh and Princeton Streets, on which it proposes to erect a two-story service station and factory, to cost about $600,000.

ELGIN, ILL.—The erection of a new power plant is under consideration by the Illinois Watch Case Company.

KINCAID, ILL.—The Peabody Coal Company is planning to build a power house, 45 ft. by 110 ft., to cost about $25,000.

MILWAUKEE, WIS. — The Chicago, North Shore & Milwaukee Railroad Company, of Highwood, Ill., it is reported, will soon begin work on the erection of a station at Sixth Street, between Sycamore and Clyborn Streets, Milwaukee, to cost about $250,000.

TWO RIVERS, WIS.—Lockwood, Greene & Company, consulting engineers, Chicago, Ill., have been engaged by the F. Eggers Veneer Seating Company to design and supervise the construction of an addition to its plant and an extension to a power house, 20 ft. by 40 ft., to cost about $100,000.

WOODSTOCK, WIS. — Bonds to the amount of $25,000 have been authorized for improvements to the municipal electric light plant.

MINNEAPOLIS, MINN. — The City Council is considering the installation of 100 additional fire-alarm boxes, new terminal switchboards and other improvements necessary to meet the requirements of the National Board of Underwriters. J. F. Wallace is chairman.

ST. JAMES, MINN.—Bonds to the amount of $30,000 been voted for improvements to the lighting and sewer systems.

CLEGHORN, IOWA.—An election will be held on June 12 to vote on the proposal to grant the Iowa Light, Heat & Power Company of Carroll a franchise to supply electrical service in Cleghorn.

STORY CITY, IOWA. — Bonds to the amount of $50,000 have been voted for rebuilding the municipal electric light plant.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company has purchased a site adjoining its power plant extending west to the Missouri River.

WAKENDA, MO.—The installation of an electric light plant in Wakenda is under consideration.

FARGO, N. D.—Bids will be received by E. G. Guthrie, secretary board of education of Fargo, until July 2 for equipment for the new combination school, including machine-shop equipment, woodworking equipment, clocks, bells, telephones and fire-alarm system and electric light fixtures, etc.

SIOUX FALLS, S. D.—Work has begun on the erection of the addition to the power plant of the Northern States Power Company at the falls, to cost about $300,000.

WATERTOWN, S. D.—The installation of a central heating plant is under consideration by the City Council, to cost about $140,000. E. A. Larsen of St. Paul, Minn., is engineer. B. N. Hagna is chairman of heating project.

LAWRENCE, NEB.—The installation of an electric lighting system, to cost about $6,000, in Lawrence is under consideration.

OMAHA, NEB.—The City Council is considering replacing 800 gas lamps with electric lamps throughout the city.

OSHKOSH, NEB.—A special election will be held June 10 to vote on the proposal to issue $9,750 in bonds for the installation of an electric lighting system in Oshkosh.

MANHATTAN, KAN.—The plant and holdings of the Marshall County Power & Light Company of Blue Rapids has been purchased by the Rocky Ford Milling & Power Company of Abilene. The latter company operates a hydroelectric plant and supplies service to six towns. Work has been started on the erection of a transmission line connecting the two plants. With the completion of this line the system will supply energy to about 50 towns including Camp Funston. Arthur Groesbeck, manager of the Rocky Ford Company, will manager the Marshall County system from Manhattan.

Southern States

HIGH POINT, N. C.—The High Point Exposition Company is contemplating the construction of a building in High Point for displaying samples of furniture made in the South. The cost is estimated at between $400,000 and $500,000. Charles F. Long is interested.

WILMINGTON, N. C.—The Hamme Marine Railway Company is reported to be contemplating the construction of a plant to build steel and wooden ships. Electrically operated machinery will be installed. R. F. Hamme, Jr., is president.

PORT ORANGE, FLA.—Bonds to the amount of $9,000 have been voted for the installation of a municipal electric light plant.

SAVANNAH, GA.—Interests, headed by Imbris & Company, are planning to establish a meat-packing plant in Savannah, to cost about $1,500,000. An electric light and power plant and refrigerating plant and by-products plant will be installed in connection with the proposed project. James Imbris of New York, N. Y., is president of Imbris & Company.

FRIENDSHIP, TENN.—The Marvel Mill Company is contemplating building an addition to its electric plant and mill.

MONTGOMERY, ALA.—The Montgomery Light & Traction Company has petitioned the City Commissioners for permission to build a 1-mile extension to Wright Field.

UNION SPRINGS, ALA.—Bonds to the amount of $10,000 have been voted for improvements to the electric light and water plants and to purchase a truck for the Fire Department.

ROLLING FORK, MISS.—The City Council has engaged Xavier A. Kramer, consulting engineer, Magnolia, to prepare plans for construction of electric light, plant, waterworks, sewerage system, etc.

OKOLONA, ARK.—R. H. Andrews is planning to erect an electric plant on the Antoine River, 4 miles from Okolona.

BEGGS, OKLA.—The Beggs Power & Ice Company is planning to equip a plant, to cost about $100,000. C. C. Kimble and W. H. Reading are interested in the project.

COMANCHE, OKLA. — Bonds to the amount of $35,000 were recently voted for extensions and improvements to the municipal electric light plant and waterworks system.

NORMAN, OKLA.—The erection of a laundry, to cost about $35,000, at the Oklahoma State Hospital is under consideration; also the completion of the heating, power and ice plant, at a cost of $45,000.

PAWNEE, OKLA. — The local electric light plant recently sold at a foreclosure sale was purchased by H. A. Carmichael, trustee for the bondholders, at $32,000.

Pacific and Mountain States

SEATTLE, WASH.—Acting Mayor Lane has decided to allow the ordinance appropriating $30,000 to finance drilling operations at Diablo Canyon and Ruby Creek to become a law without his signature. Plans will be prepared at once by A. H. Dimock, engineer, for a complete investigation of the Skagit project, the first work to consist of borings at the site of the proposed Ruby Creek dam.

VALLEY, WASH.—Arrangements are being made by the farmers on the west side of the valley to erect an electric transmission line from the local system to that neighborhood.

GLENADA, ORE. — The Glenada Mill, Light & Power Company, recently organized, proposes to operate a mill in Glenada and also to supply electricity for lamps and motors to the city.

CHICO, CAL.—The City Trustees have adopted a resolution asking the Railroad Commission to appraise the electric distributing systems of the Northern California Power Company and the Pacific Gas & Electric Company in Chico. The city is contemplating municipal ownership of the lighting systems.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission until June 27, for machinery for the municipal power plant No. 2 in the San Francisquito Canyon, including hydraulic equipment, electric generators, transformers, auxiliary electric equipment, etc. The cost is estimated at about $500,000.

LOS ANGELES, CAL.—Specifications for the installation of the ornamental lighting system on Broadway from California Street to Tenth Street have been approved by the Public Service Commission. The system will consist of 134 lamps mounted with two 1600-cp. lamps. A temporary system is now being installed to be used during the change from the old to the new system. The cost is estimated at about $100,000.

ORLAND, CAL.—Owing to the increase in rates the Orland Water Users' Association is contemplating the installation of an independent telephone system, the service te bo provided at cost to the legal water users in the Orland project. There are more than 700 using water supplied by the association.

BOISE, IDAHO.—The Idaho Power Company is planning to erect a transmission line from American Falls to Pocatello, a distance of 25 miles. The company is now installing a 3600-kva. generating unit at its Lower Salmon hydroelectric plant.

OASIS, UTAH.—The Deseret Irrigation Company and the Melville Irrigation Company have applied to the Public Utilities Commission for permission to supply electricity in several towns in Millard County. The companies contemplate the construction of a second power plant on the Savior River near Delta and propose to furnish electrical serviec in Delta, Oasis, Deseret and Hinckley.

DENVER, COL.—The Colorado Pitchblende Company is reported to have purchased the power plant and water rights in South St. Vrain Canyon, owned by the John L. Neble Company. The property includes 160 acres of timber land and a power and compressor plant, which will be used in connection with the mining and milling operations in the Jimtown district of Boulder County. By impounding the water at the head of the St. Vrain, it estimated that the generating capacity of the power plant can be increased by several thousand horsepower.

MONTROSE, COL.—The installation of a municipal electric light plant in Montrose is under consideration.

Canada

GODERICH, ONT.—The erection of a new transmission line to transmit 25,000 hp. from the system of the Hydro-Electric Power Commission for the proposed plant of the Lake Huron Steel Corporation, recently incorporated with a capital stock of $15,000,000, to manufacture high carbon steel, is under consideration. B. H. McCreath of Toronto, and F. W. Craigie of Goderich are interested in the company.

ST. CATHARINES, ONT.—The Niagara, St. Catharines & Toronto Railway Company, it is reported, contemplates the reconstruction of several miles of track within the city of St. Catharines, the erection of new overhead work on the line between St. Catharines and Thoroid, enlarging and transforming of the park at Port Dalhousie into a pleasure ground, etc.

Miscellaneous

KINGSTON, JAMAICA — Arrangements are being made by the government for a survey of the water power of the larger rivers in Jamaica to see if equipping the railways for electrical operation is now feasible.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 23, under circular 1282, for copper wire, and cable, condenser tubes and thimbles, copper, watt-hour meters, motor-generator sets, starting compensators, transformers, fans, busbar supports, end bells, connectors, receptacles, reflectors, sockets, studs, switches, fuses, pipe clamps, globes and cypress lumber. For further information address the above office.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 17 for castings, forgings, metal workers' tools and machines, Klaxon horns, copper cable, wire conduit, electric fans, fixtures, fuses, meters, reflectors, sleeves, sockets, switches, transformers, etc., Blanks and information relating to this circular (1281) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 29 South La Salle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual meeting, Lake Placid, N. Y., June 24-27.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa. Annual meeting, Atlantic City, N. J., June 24-27.

ARKANSAS UTILITIES ASSOCIATION. Secretary, W. J. Tharp, Little Rock, Ark. Annual convention, June 10, 11 and 12, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass.

ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS OF ONTARIO. Secretary, R. A. Clement, 190 University Ave., Toronto, Ont., Can. Annual convention, Niagara Falls, Ont., June 19-21.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, St. Louis, Mo., Sept. 22-26.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Power Company, 12 Adelaide St., East, Toronto, Ont. Annual meeting, Alexandria Bay, N. Y., June 27-28.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy. 900 15th St., Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 110 West 40th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegerman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Annual meeting, Hot Springs, Va., June 10, 11 and 12.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Chicago, October.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual meeting, Chicago, Sept. 23-26.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa. Annual meeting, Colfax, Iowa, June 18, 19 and 20.

JOVIAN ORDER. Jupiter (president), J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary and treasurer, Meyer Barnest, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary, E. S. Meyers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo. Annual meeting, June 5-7, Excelsior Springs, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania Tennessee and Wisconsin. Annual meeting, Milwaukee, Wis., July 14-18.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass. Annual meeting, Springfield, Mass., Oct. 13 and 14.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass. Annual meeting, Boston, Mass., June.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, Ohio, July 15-17.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 4171 Beaufort Avenue, Woodlawn, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual convention, Asheville, N. C., Sept. 17-19.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Greenwood, S. C., June 17-19.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

Record of Electrical Patents

Notes on United States Patents

(Issued May 30, 1919)

1,303,964. ELECTRIC WELDING TRANSFORMER; Adolph F. Rietzel, Charlestown, R. I. App. filed Oct. 3, 1918. Permits free movement of the work platens.

1,303,989. TEMPERATURE INDICATOR; Nathan H. Suren, Needham, Mass. App. filed Feb. 6, 1915. Indicates or records by electrical transmission temperature conditions.

1,304,000. MEANS FOR AUTOMATICALLY CONTROLLING ELECTRIC HEADLIGHTS FOR AUTOMOBILES; Harry E. Wallace, Paducah, Ky. App. filed Sept. 27, 1915.

1,304,008. CONTROLLING DEVICE; Paul H. Zimmer, Milwaukee, Wis. App. filed Feb. 4, 1915. Effects sequential operation of the circuit-controlling parts.

1,304,010. MOVING-PICTURE INDICATOR; Lemoine J. Bechtold, Denver, Col. App. filed Nov. 14, 1917. Time-controlled program.

1,304,022. ELECTRICAL INDICATING DEVICE; Samuel F. Cole, Purcellville, Va. App. filed May 25, 1915. Indicates the quantity of liquids of an explosive nature.

1,304,024. PROTECTOR; Wallace L. Cook, Chicago, Ill. App. filed Feb. 9, 1917. Pencil fuse.

1,304,025. TELEGRAPH SENDING MACHINE; William C. Cozad, Chicago, Ill. App. filed Feb. 12, 1918.

1,304,040. OUTLET BOX; Albert Guth, Perth Amboy, N. J. App. filed May 1, 1916. All fixtures can be adapted to box.

1,304,075. ELECTRICAL CONNECTOR; John Lofgren, Chicago, Ill. App. filed Sept. 29, 1917. For several conductors.

1,304,076. TELEPHONE-EXCHANGE TRUNKING SYSTEM; Fritz Lubberger, Chicago, Ill. App. filed May 6, 1910.

1,304,101. CHOCOLATE-HEATING APPARATUS; John G. Rote, Belmont, Mass. App. filed Aug. 29, 1918. Easily regulated.

1,304,132. SYSTEM OF BOOSTING ELECTRIC LINES; Albert Werner, Berlin-Fiedenau, Germany. App. filed Nov. 25, 1913. Avoids surplus of boosting voltage.

1,304,146. ELECTRICALLY HEATED PUFF IRON; David Bertuleit, Portland, Ore. App. filed June 22, 1918. Head approximately ovoidal.

1,304,169. ARRANGEMENT FOR FORMING ELECTRICAL ARCS; Bertalan Duschnitz, Berlin, Germany. App. filed July 14, 1911. Produces an arc without moving the electrodes.

1,304,172. DIRECTION SIGNAL FOR VEHICLES; Carl Fredriksen, Lackawanna, N. Y. App. filed Aug. 22, 1917.

1,304,178. ELECTRICAL SYSTEM OF POWER TRANSMISSION; William S. H. Hamilton, Schenectady, N. Y. App. filed March 24, 1916. Motor separately excited.

1,304,181. ELECTRIC SHIP PROPULSION; Henry M. Hobart, Schenectady, N. Y. App. filed Sept. 21, 1916. Propellers are driven by polyphase induction motors.

1,304,184. TRANSFORMER; Svend E. Johannesen, Pittsfield, Mass. App. filed Nov. 11, 1915. Relocates leads in transformers of multi-layer coils.

1,304,188. CONTROLLING APPARATUS FOR WIRELESS TELEPHONE SYSTEM; David G. McCaa, Lancaster, Pa. App. filed June 4, 1918.

1,304,192. NEGATIVE PLATE FOR LEAD STORAGE BATTERIES; William Morrison, Chicago, Ill. App. filed Sept. 23, 1918. Possesses a high and uniform electrical conductivity.

1,304,203. LIGHTING SYSTEM; Albert P. Robinson, Kenvil, N. J. App. filed Aug. 9, 1917. Series system which allows lighting although ore burns out.

1,304,210. INDUCTION-MOTOR CONTROL; Newton Shuttleworth and George M. Brown, Rugby, Eng. App. filed March 16, 1916. Speed control for flywheels.

1,304,214. BATTERY ADAPTER; Maxwell H. Smith, Philadelphia, Pa. App. filed April 13, 1918. For flashlight.

1,304,217. PRESSURE-CONTROLLED SWITCH; Edmund E. Taeubert, Los Angeles, Cal. App. filed Oct. 28, 1914. Maintains predetermined pressure in electric railway car.

1,304,222. PROCESS OF EXTRACTING MANGANESE AND MAKING SULPHURIC ACID AND MANGANESE DIOXIDE; George E. Van Arsdale and Charles G. Maier, New York, N. Y. App. filed April 18, 1918.

1,304,226. ELECTRIC BOX; Frederick H. Ward, Brooklyn, N. Y. App. filed May 1, 1913. Outlet box.

1,304,227. WELDING ELECTRODE; James M. Weed, Schenectady, N. Y. App. filed Nov. 4, 1918. Material extremely rigid.

1,304,229. HIGH-SPEED GRINDING MACHINE; John B. Wiard, Lynn, Mass. App. filed July 3, 1915. Electrically driven.

1,304,230. LEAD BUSHING; James Wilkinson, Pittsfield, Mass. App. filed Oct. 7, 1916. Oil-filled.

1,304,236. DISCONNECTING DEVICE FOR ELECTRIC SUPPLY CIRCUITS; Charles H. Wordingham, Redhill, Eng. App. filed Aug. 12, 1918. In case of flooding, fire, etc.

1,304,237. SYSTEM FOR DISTRIBUTING ELECTRIC ENERGY; Charles H. Wordingham, Redhill, Eng. App. filed Aug. 12, 1918.

1,308,239. ELECTRICAL SYSTEM OF POWER TRANSMISSION; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed March 11, 1916. Regenerative control.

1,304,240. ELECTRIC SYSTEM OF SHIP PROPULSION; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed March 22, 1916. Two different speed ranges.

1,304,247. INSULATOR; Omer C. Barger, Indianapolis, Ind. App. filed June 24, 1918. High-tension glass.

1,304,252. ENGINE-STARTING DEVICE; Joseph Bijur, New York, N. Y. App. filed July 7, 1914.

1,304,257. ELECTRICAL APPARATUS; Frederick F. Brand, Pittsfield, Mass. App. filed Feb. 2, 1917. Wall-coiled transformers, reactances, etc.

1,304,269. DISTANT CONTROL OF MECHANISM SUCH AS GUN SIGHTS OR TURRETS; Arthur T. Dawson, and George T. Buckham, Westminster, London, Eng. App. filed April 13, 1915.

1,304,282. MEANS FOR SUPPORTING ELECTRODES IN IONIC TUBES; Oswald Durdle, London, Eng. App. filed Aug. 9, 1918.

1,304,283. INSULATING BUSHING; Eugene D. Eby, Pittsfield, Mass. App. filed May 24, 1918. Resists surges, corona and other transient phenomena.

1,304,288. SHIP PROPULSION; William L. R. Emmet, Schenectady, N. Y. App. filed March 11, 1916. Drives high-speed, high-power vessel at plurality of different speeds.

1,304,289. SYSTEM OF SHIP PROPULSION; William L. R. Emmet, Schenectady, N. Y. App. filed March 15, 1916.

1,304,290. ELECTRIC SYSTEM OF SHIP PROPULSION; William L. R. Emmet, Schenectady, N. Y. App. filed March 1, 1916.

1,304,296. RADIO-SIGNALING SYSTEM; Chas. Le G. Fortescue, Pittsburgh, Pa. App. filed Dec. 2, 1916.

1,304,308. TELEPHONE ATTACHMENT; Eugene Gransauli, New York, N. Y. App. filed June 30, 1915.

1,304,324. INDIVIDUAL-SWITCH MECHANISM FOR AUTOMATIC TELEPHONE SYSTEMS; Alexander E. Keith, Chicago, Ill. App. filed April 29, 1905.

1,304,335. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Oct. 26, 1916.

1,304,342. INSULATING COUPLING FOR FENCE WIRES; James L. Martin, Yates Center, Kan. App. filed June 22, 1917. Eliminates live-stock killing.

1,304,350. ELECTRIC FURNACE; William E. Moore, Pittsburgh, Pa. App. filed June 11, 1917. Arc-type electric metallurgical furnaces.

1,304,356. TELEGRAPH SOUNDER; Thomas J. Murphy, Rochester, N. Y. App. filed Nov. 30, 1917.

1,304,365. MOTOR HEATER AND LIKE DEVICE; Walter B. Powell, Quebec, Can. App. filed Jan. 28, 1918. For gas engines.

1,304,369. TELEPHONE SYSTEM; Arthur J. Ray, Liverpool, Eng. App. filed Jan. 26, 1915.

1,304,376. ELECTRIC CURRENT INTERRUPTER; Miguel B. Rodriguez, Madrid, Spain. App. filed Dec. 22, 1917.

1,304,377. ELECTRIC SWITCH; Even J. Rohne, Minneapolis, Minn. App. filed Oct. 1, 1917. Straight-through cut-off type.

1,304,425. ELECTRIC FURNACE; Harold G. Weidenthal, Cleveland, Ohio. App. filed Nov. 16, 1918. Equally applicable to direct-current or alternating-current system.

1,304,444. REINFORCED JOINT FOR CARBON ELECTRODES; William P. Bidelman, Los Angeles, Cal. App. filed Oct. 1, 1918. Prevents breaking.

1,304,451. TRANSFORMER; Locke H. Burnham, Pittsfield, Mass. App. filed Jan. 29, 1917. Increase in capacity secured by better cooling or ventilation.

1,304,453. ELECTROMAGNETIC LOCKING DEVICE; Louis Cadenel, Paris, France. App. filed May 27, 1914. For safes.

1,304,461. TELEPHONE ATTACHMENT; George Dorsey, Seattle, Wash. App. filed April 20, 1918.

1,304,469. OIL-FILLED LEAD BUSHING; John J. Frank, Pittsfield, Mass. App. filed Oct. 30, 1916. Bushing collar makes parts integral.

1,304,491. QUICK-SERVICE ATTACHMENT PLUG; Albert C. Kong and Wah Chong Kam, Honolulu, Hawaii. App. filed Nov. 26, 1918. Can be snapped into Edison base.

1,304,503. CARBON HOLDER FOR ELECTRIC ARC LIGHTS; Ralph C. Miller, Los Angeles, Cal. App. filed Nov. 7, 1917. Extension carbon holder.

1,304,522. ELECTRIC REGULATOR; Joseph Bijur, New York, N. Y. App. filed Aug. 13, 1914.